DETAILED REPORTS OF SUBORDINATE OFFICERS OF THE DEPARTMENT OF AGRICULTURE, MADRAS, FOR 1942-43.

DETAILED REPORT OF THE GOVERNMENT AGRICULTURAL CHEMIST, COIMBATORE, FOR THE YEAR 1942-43 (FASLI).

I submit herewith the detailed report of work done in the Government Agricultural Chemist's section during the fasli year 1942-43.

I was in charge of the section throughout the year except for the entire month of February 1943 when I was on leave on average pay and six weeks thereafter when I acted as Director of Agriculture during the period when Mr. P. H. Rama Reddi was granted leave. The work of the section is reported, as usual under three major heads—(I) General including analytical and advisory work; (II) Teaching and (III) Research on problems on soil science, manuring, plant and animal nutrition, microbiology and agricultural industries.

I.—General.

Meteorology—Observations of the climatological conditions at 8 00 hours I.S.T. were recorded daily at the observatory at the Agricultural Research Institute.

The table below gives a summary of the records maintained at the Agricultural Research Institute for the year 1942-43 (April 1942—March 1943).

COMMONWEALTH MYCOLOGICAL INSTITUTE
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TABLE I.

Year and month.	Temperatures.						Relative humidity.			Rainfall.			Number of rainy days.	Wind velocity.		
	Absolute maximum in shade.	Absolute minimum in shade.	Mean maximum in shade.	Departure from normal.	Mean minimum in shade.	Departure from normal.	For the month at 8 hours.	Mean for the month.	Departure from normal.	Actual for the month.	Mean for the month.	Departure from normal.		Average for the month.	Mean.	Departure from normal.
1942	°F	°F	°F	°F	°F	°F	PER CENT.	PER CENT.	PER CENT.	INCHES.	INCHES.	INCHES.		MILE PER HOUR.	MILE PER HOUR.	MILE PER HOUR.
April	100·6	69·3	96.1	+0·5	73·6	+0·5	66·5	71·1	—4·6	2·83	1·88	+0·95	3	2·0	2·6	—0·6
May	100·8	70·2	94·9	—0·1	72·5	—1·5	69·2	70·2	—1·0	2·08	2·69	—0·61	4	2·0	3·7	—1·7
June	96·8	69·6	89·1	+0·1	73·8	+0·7	68·4	69·5	—1·1	0·81	1·48	—0·67	3	5·9	7·4	—1·5
July	91·5	69·5	85·8	—0·7	70·9	—1·4	68·7	71·9	—3·2	0·81	2·08	—1·27	2	6·5	8·6	—2·1
August.. ..	91·4	69·0	87·4	+0·5	72·2	+1·1	73·1	74·0	—0·9	2·04	1·19	+0·85	5	4·6	7·0	—2·4
September ..	92·0	67·0	89·6	+0·1	70·7	+0·2	73·0	73·5	—0·5	0·67	1·79	—1·12	1	3·2	5·3	—2·1
October ..	91·2	66·0	86·7	—0·8	70·1	—0·3	83·2	79·9	+3·3	6·37	5·70	+0·67	11	0·7	2·8	—2·1
November ..	89·7	59·6	87·4	+2·9	66·6	—1·9	72·4	80·6	—8·4	0·52	4·80	—4·28	3	0·9	2·2	—1·3
December ..	90·0	63·6	83·0	—0·8	68·6	+3·5	84·6	78·8	+5·8	4·00	1·49	+2·51	8	1·1	3·0	—1·9
1943																
January ..	89·0	60·0	83·4	—2·5	64·9	+0·7	81·5	76·2	+5·3	3·93	0·70	+3·23	4	1·4	3·0	—1·6
February ..	93·0	56·2	87·8	—2·7	65·4	—6·4	72·4	71·9	+0·5	1·11	0·52	+0·59	2	1·5	2·8	—1·3
March	97·4	59·9	94·8	Nil.	68·3	—1·4	66·6	69·7	—3·1	0·02	0·81	—0·79	Nil.	1·4	2·7	—1.3
								Total ..		25·19	25·13	+0·06				

The total rainfall for the entire year was nearly normal. The rainfall during April was slightly above normal, while that for May was below normal. The south-west monsoon failed in June and July. The most characteristic feature was the total failure in November with the north-east monsoon, while very heavy rains were received in December and January. Though the total rainfall was just normal the seasonal conditions during the north-east monsoon were unfavourable with failure in November and exceptional rains in December and January. This resulted in a large scale failure of the cholam crop which agravated the difficult food situation. Other climatic elements were fairly normal.

Analytical and Advisory.—This item of work which forms one of the major activities of the section was in full swing throughout the year. This branch analyses samples of soils, manures, feeding stuffs, waters for irrigation and other agricultural products, malt foods and malt extract and tenders advice to those who sent them. The parties who seek such advice include ryots and landlords, members of the United Planters' Association of Southern India, members of the Agricultural Department and other Government Departments. In addition samples received in the course of the research activities of sections were also dealt with.

The samples during the period under report are detailed and classified in table below according to the nature of the samples and source of receipt :—

TABLE II.

	Research.	Agriculture Department.	Other Government Departments.	Ryots and private parties.	UPASI.	Total.
Soils ..	19	56	25	8	6	114
Manures and composts.	..	22	..	51	5	78
Foods and fodders.	80	109	51	..	..	240
Waters ..	4	13	471	4	..	492
Sugarcane juices.	..	402	..	..	..	402
Miscellaneous.	199	47	1	3	..	250
Total ..	302	649	548	66	11	1,576

A sum of Rs. 1,177 was collected during the year as analytical fees which comprised Rs. 456 from members of the United Planters' Association of South India and the remainder from bona fide ryots and private parties.

Besides sending analytical reports on the above samples and rendering advice wherever necessary, numerous enquiries from private parties and officers of the Agricultural and other Government departments, relating to the activities of the section, were received and answered from time to time.

Of the samples analysed and reported on during the year, the following may be mentioned as of special interest :—

(1) A sample of Gogu silage received from the Agricultural Research Station, Guntur, had the following composition :—

	PER CENT.
Moisture	7·30
Ash	12·85
Crude proteins	13·90
Ether extractives ..	9·23
Crude fibre	15·76
Carbohydrates	40·96
Total ..	100·00
Insolubles	3·01
Lime (CaO)	4·06
Phosphoric acid (P_2O_5).	0·34

The silage was found to be rich in proteins and carbohydrates, fairly comparable in nutritive value to medium quality concentrates.

(2) A sample of night soil compost received from the Agricultural Demonstrator, Rajahmundry, though of average quality with 1·5 per cent nitrogen, 0·8 per cent phosphoric acid and 0·9 per cent potash, had a high percentage (60 per cent) of insoluble matter. Attention was drawn to the need for screening away and excluding inert material like stones, earth, etc., before composting.

(3) Two samples of tapioca roots—*Tapein* and *Haparica*—received from the Agricultural Research Station, Taliparamba were examined for food value and hydrocyanic acid content with the following results :—

	Tapein.	*Haparica.*
	PER CENT.	PER CENT.
Moisture	60·34	57 98
Ash	0·78	0·90
Crude proteins ..	2·62	1·45
Ether extractives	0·08	0·14
Crude fibre	0·04	1·27
Carbohydrate	36·14	38·26
Total ..	100·00	100·00
Hydrocyanic acid in edible portion.	0·021	0·024

The presence of dangerously high quantities of hydrocyanic acid in the roots pointed to the necessity for exercising care in their utilisation for food. It was found that a preliminary boiling in water and draining away of the water reduced the amount of hydrocyanic acid in both the varieties to almost nil. Air drying of the roots, however, did not render them innocuous.

(4) At the instance of the District Agricultural Officer, Tirunelveli, and the Millets Specialist, Coimbatore, samples of grain from four Cumbu selections KC. 8, KC. 105, KC. 292 and PT. 700 were analysed for food value and the results compared with those of two local cumbu varieties grown in the Agricultural Research Station, Koilpatti.

	KC. 8	KC. 102	KC. 292	PT. 700	Local irrigated.	Local manured seasonal or rainfed.
	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.
Moisture ..	10·77	10·31	10·30	9·88	10·91	11·32
Ash	2·46	2·25	3·39	2·78	5·82	3·86
Crude protein.	6·92	6·37	13·82	13·96	11·05	7·70
Ether extractives.	5·63	6·13	6·91	7·23	5·46	5·38
Crude fibre ..	1·35	1·42	1·54	1·02	1·86	1·81
Carbohydrates.	72·87	73·52	64·04	65·13	64·90	69·93
Total ..	100·00	100· 0	100·00	100·00	100·00	100·00
Insolubles ..	0·66	0·58	0·93	0·39	3·76	2·04
Lime (CaO) ..	0·06	0·05	0·07	0·05	0·06	0·06
Phosphoric acid (P_2O_5).	0·75	0·73	1·13	1·16	0·83	0·74

It will be seen that PT. 700, a selection made at the Millets Breeding Station, Coimbatore, from a variety of cumbu from Nigeria is the best in point of food value. This selection is said to be popular and suited to irrigated as well as rainfed conditions. Next in rank is KC. 292, a selection made from Kodai Cumbu at Koilpatti (irrigated). The above two strains grown under irrigated conditions are superior to local irrigated cumbu. The other two selections, viz., KC. 8 and KC.105 grown under rainfed conditions, though not superior to are as good as local cumbu grown as manured seasonal or rainfed crop.

(5) Studies on the agronomic and chemical aspects of pineapple cultivation on the west coast were concluded. The conclusions arrived at are given below :—

(*a*) Agronomic studies show that there are two harvest seasons—summer and winter—independent of the time of planting, the summer harvest (May-June) being the richer of the two. Maximum yields are obtained from May and October plantings, but with a delayed bearing of over 8 months in the latter case.

(*b*) Analysis of fruits from the monthly planting trials over three seasons for general sugar content and acidity reveals the superiority of fruits picked in summer. The harvest season influences the composition more than the time of planting, no

significant difference being observed among fruits examined over a particular season irrespective of the time of planting.

(c) From point of view of yield and quality, May planting is to be commended, though October planting may also be adopted with delayed bearing.

(6) Eighteen samples of rice prepared by different processes, viz., shelled in huller, once polished and twice polished, from the same variety (CO.16) of paddy grown in different parts of the presidency were analysed for the Paddy Specialist, Coimbatore. The following are the average results for each group :—

Treatment.	Ash.	Crude protein.	Ether extractives.	Crude fibre.	Carbohydrate.	P_2O_5	CaO
	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.	PER CENT.
Shelled.	1·69	6·24	2·78	1·20	76·10	0·71	0·043
Once polished.	1·01	6·13	1·41	0·49	78·80	0·59	0·021
Twice polished.	0·62	5·78	0·48	0·43	80·90	0·26	0·021

The loss in nutrition as a result of polishing is striking, the shelled rice being the richest and the twice polished the poorest in food value. The higher the degree of polish, the greater is the loss of nutrients like protein, fat and phosphates.

(7) Twelve samples of soil and a sample of irrigation water taken from blocks of unproductive land in Tharimela village, Anantapur district, were analysed for the District Agricultural Officer, Anantapar, with a view to trace the cause of unproductivity. The results showed that the lands had developed alkalinity as a result of continued irrigation with the Pennar water which contained a high percentage of soluble salts, mostly those of sodium. Though the usual methods of reclamation are not likely to completely restore the soil to normal owing to the harmful salts contained in the irrigation water, palliative measures such as improving drainage conditions, incorporation of heavy doses of organic matter and bunding of fields with a view to impound rain water and allow it to percolate into the drains during the rains, were recommended.

(8) Ten samples of pasture grass from replicated manurial trials at the Agricultural Research Station, Taliparamba—control (unmanured) and manured with lime and bone meal over a basal dressing of cattle manure—were analysed with the following average results :—

	Crude protein.	Lime.	P_2O_5
	PER CENT.	PER CENT.	PER CENT.
Control (unmanured) ..	4·35	0·45	0·14
Manured	4·52	0·82	0·26

There was an all round improvement in quality of herbage as a result of manurial treatment, the manured sample being richer in protein, lime and phosphoric acid than the unmanured ones. The experiments have been advised to be continued till confirmatory results are obtained.

(9) A sample of malt refuse from cholam grain, left over after extraction for making malt extract, was analysed to assess its value as cattle food. The figures are given below :—

	PER CENT.
Moisture	9·39
Ash	1·69
Crude proteins	12·52
Ether extractives	2·45
Crude fibre	1·80
Carbohydrates	72·15
Total ..	100·00
Lime (C_aO)	0·10
Phosphoric acid	0·55

The sample was deficient in ether extractives and ash content. In combination with the usual mineral mixture it might serve as a useful cattle food.

(10) A sample *Cassia Auriculata* flowers collected locally was analysed for food value. These flowers are met with in abundance in certain areas of Anantapur district where the local people use the petals for the preparation of curries, etc. The Deputy Director of Agriculture, Central Division, was interested in having a sample analysed. The figures given below show that it has a fair feeding value :—

	On dry basis.	On original moisture basis.
	PER CENT.	PER CENT.
Moisture	..	74·25
Ash	6·50	1·51
Crude protein	11·92	2·76
Ether extractive	4·53	1·05
Crude fibre	12·60	2·92
Carbohydrates	64·45	14·51
Total ..	100·00	100·00

(11) The Provincial Marketing Officer, Madras, remarked that the eating qualities of Satsugudi oranges harvested in the main season (August–November) and in the off-season (June) differed to some extent. With a view to ascertain how far this statement could be supported by actual analysis of fruits, it was arranged to take up typical samples of fruits harvested during the two seasons for examination. The results of analysis of

samples containing 20 fruits each (medium grade 3 inches) are tabulated below :—

	Main season.	Off season.
Average weight of fruit ..	246 gms.	231 gms.
Percentage rind to fruit ..	22·69	22·67
,, seed to fruit ..	2·07	2·23
,, juice to fruit ..	47·25	49·78
,, rag to fruit ..	27·99	25·32
	100·00	100.00
Percentage pulp to fruit..	77.31	77.33
,, seed to pulp ..	2·69	2·88
,, juice to pulp.	63·93	66·28

Juice analysis

(Expressed as per cent on weight of juice.)

Total solids (degree Brix).	13·3	10·4
Water	86 7	89·6
Total sugars	10·14	7·13
Reducing sugars	3·60	2·89
Sucrose	6·54	4·24
Total acidity (as citric acid)	0·44	0·70
Sugar : Acid ratio ..	23 : 1	10 : 1

Judged by the above analysis, both the normal and off-season fruits are marketable, though the normal season fruits with their higher total solid content and sugar : acid ratio are decidedly superior to those of the off-season in eating quality.

(12) A sample of rain tree pods received from the District Agricultural Officer, Tanjore, was examined for its feeding value and sugar content. The results are given below :—

	PER CENT.
Moisture	8·93
Ash	4·33
Crude proteins	11·23
Ether extractives	0·21
Crude fibre	27·14
Carbohydrates	48·16
	100·00
Lime (C O)	0·33
Phosphoric acid (P_2O_5)	0:34
Insolubles	0·94
Total reducing sugars (hydrolysable) ..	33·36
Reducing sugars	18·81
Sucrose	13·82

The pods had fair feeding value, but owing to their high sugar content they were not suitable for feeding to cattle in large quantities. Nor was the stuff suitable for the production of sugar owing to its high concentration of reducing sugars. The rab prepared from the pulp did not crystallise even on long standing.

(13) On a requisition from the Executive Engineer, Salem Division, water samples periodically collected at different points in the Mettur Reservoir are being examined for total and suspended solids with the idea of making systematic observations on silt accumulation. Four hundred and seventy-one samples of water were examined and reported on during the year. It is proposed to carry on the investigation for a total period of five years.

(14) In connexion with the proposed construction of a reservoir across the Pennar near Gandikota in Jammalamadugu taluk, Cuddapah district, analysis of samples of irrigation water periodically drawn from the neighbourhood of the proposed reservoir is being carried out with a view to study seasonal variations in quality. From data so far collected it is found that though with the advent of freshes in the river during the north-east monsoon the soluble salt content is reduced to a minimum, there is wide variation from month to month during other seasons of the year. The sample drawn in May 1943 was very bad, containing 182·6 parts of soluble salts per 100,000 most of which are those of sodium. The analysis of sample will be continued and a detailed report submitted early in 1944.

II.—Teaching.

Degree course of the Madras University.—The College reopened on the 15th June for the second and third year students and on the 2nd of July for the fresh admissions to the first-year class. The statement appended below gives the number of lectures delivered and the practical classes held during the academic year 1942–43 :—

Class.	Lecture classes.	Practical classes.
B. Sc. Agriculture I.	63	61
,, II.	62	32
,, III.	136	98

Short course of the Agriultural College—(a) Malt making.—A course of lectures on malt and malt making was given to students of the short course in Farm Management from the 1st to 12th September, both days inclusive. Sixteen students underwent the course. Eight lectures and two demonstrations and a final written test were arranged. The usual course of malt making was extended so as to include the preparation of malt extract as such and with shark liver oil to provide vitamin A.

(*b*) *Jaggery making.*—A similar course of lectures on jaggery making was arranged from the 15th to 28th February 1943. Sixteen students of the short course attended it. The methods of preparing ordinary and cream jaggery from cane and cocunut juices were demonstrated and five lectures were delivered on the composition of the cane. The students had the benefit of a visit to the Podanur Sugar factory where full details of manufactured of sugar and working of the factory were explained.

III.—Research.

A. Soils.

(i) *Reclamation of alkaline lands under dry conditions.*—Experimental plots were laid out at Peddapalakalur near Guntur and soil samples were taken at the time of lay-out of the plots and analysed. The object is to utilize the rain in washing out the salts. To this end the plots are bunded and an adequate system of drains is laid out. The water thus confined in passing through the drains, removes the salts beyond the range of the roots and thus restores fertility to the soil. Soil samples will again be taken and analysed after the north-east monsoon to ascertain the extent of removal.

(ii) *Study of soils suitable for the cultivation of Virginia tobacco.*—The work done in previous years had shown that the high quality in leaf was associated with a low soluble salt content. It was therefore expected that soils of low soluble salt content should produce the best quality of tobacco. To verify this conclusion a number of soils and the tobacco crops grown on them were analysed, but no correlation could be found between the total and available plant foods on the one hand and quality of the leaf on the other. In this investigation indication was obtained that moisture present in the soil influenced more than any other fact the quality of tobacco leaf.

Further experiments showed that lower grades of Virginia tobacco are invariably characterised by high content of mineral matter especially CaO and MgO.

(iii) *Examination of soils of the Criminal Tribes Settlement, Aziznagar.*—This investigation was undertaken to ascertain the cause of reported infertility of the soil of the settlement area. Actual analysis of soil samples taken showed that the soils were in the first stage in the formation of alkali soils, characterised by accumulation of sodium salts. Suggestions have been offered for effecting improvement of the settlement area by flooding and draining the water.

(iv) *Fundamental studies on the origin and properties of black and red soils of Madras Pesidency.*—This investigation was undertaken with a view to furnish an explanation for the formation of black and red soils, with entirely different properties, in contiguous areas from the same rock formation which is reported

to be Archaen gneisses and granites. Samples of black and red soils were drawn from two profile pits located one in a black soil area and another from an adjoining red soil area in Coimbatore taluk. The soils collected from different depths wvre analysed for mechanical composition, pH and soluble salts and then they were divided into the various mechanical fractions such as clay, fine silt, coarse silt, fine sand and coarse sand and some of these, viz., clay, fine silt and fine sand were analysed chemically. In the case of fine sand, analysis by fusion method was also made to get a measure of the minerals left unattacked by concentrated hydrochloric acid. The results indicate that the black soil of Coimbatore taluk is a (i) heavy clay while the red one collected from an adjacent area is loamy, (ii) black soil retains more moisture than red, (iii) contains more $CaCo_3$ and C by wet method, (iv) hold more water soluble salts than red soils particularly Na, Mg and Ca sulphates and NaCl and (v) higher pH.

The chemical analysis of mechanical separates show that the black clay fractions contain more of (*a*) insolubles, (*b*) CaO, (*c*) combined SiO , (*d*) True SiO_2, (*e*) Na_2O, (*f*) Silicate CaO, (*g*) Molar combined SiO_2/Al_2O and combined SiO_2/R_2O_3 ratios than red clay fractions and less of (i) R_2O_3 and (ii) MgO. Similar comparison of chemical analysis of black and red fine silt fractions reveal that black soil fine silts contain more of (i) loss on ignition—mainly due to loss of CO_2 from $CaCO_3$, (ii) Total SiO_2, (iii) Total CaO, (iv) MgO and (v) Na_2O and less of (*a*) R_2O_3 and (*b*) K_2O.

Analysis of fine sand fractions.—A similar analysis of fine sand fractions shows that soluble minerals increase with depth particularly those containing CaO in the case of black and K_2O in the case of red soils. The chief difference that exists between the black and red sand fractions is that the former contains greater amounts of silicate CaO and less of K_2O than the latter.

Analysis of fine sand by fusion.—The minerals present in the fine sand fraction of the black soils are more easily dissolved by Conc. HCl than in the red sand fraction. This is inferred from the quantity brought into solution by the fusion method which is $1\frac{1}{2}$ times that extracted by HCl in the case of black soil fraction whereas it is 5 times in the case of the red fraction. Taking CaO there is practically no difference in the amount extracted by Conc. HCl and fusion methods from fine sand fraction of black soil, whereas in the case of the corresponding fraction of red soil the fusion extracts 40 times more of CaO than HCl. This difference in the quantity of material extracted shows that the calcium silicates associated with fine sand fractions of black and red soil are different in composition and state of de-composition. It is surmised that the calcium silicates associated with black sand are probably present as chlorite and lime felspar while those associated with red sand are present as amphiboles and pyroxenes.

Base exchange capacity and exchangeable CaO.—Total base exchange capacity of black soil clays is more than twice that of red soil clays. Exchangeable CaO and silicate CaO are present in black soil clay fractions in much greater amounts than in red clay fractions.

Dehydration curves.—The determination of loss of moisture at various temperatures by black and red clay fractions and plotting the curves shows that the curve for the former resembles the curve for scolecite a calcium zeolite and that of the latter cecil clay from Alabama which is derived from igneous rocks and which has a SiO_2/R_2O_3 of 2.

Analysis of chlorite rock taken out of the excavated material from the black soil area.—The rock was analysed both by digestion with concentrated HCl and by fusion method. The black mineral which is present in the rock in abundance and which has the deceptive appearance of biotite proved to be chlorite as it contained 5·26 per cent of CaO. The chlorite is a secondary mineral derived from the amphiboles and pyroxenes (ferromagnesian silicate).

The analysis of the fractions of black and red soils seems to indicate that though both are derived from Archaen gneisses and granites, the former is derived from rocks formed from calcic magma and the latter from alkali magma. The presence of plenty of chlorite in the country rock of black soil area seems to give further evidence of the above inference.

Udamalpet black and red soils.—Investigation was continued on similar lines with soil samples collected at Udamalpet taluk of Coimbatore district from two profile pits, one black and the other red. The work done so far shows (i) that the black and red soil samples of Udamalpet resemble in their properties other black and red soils, respectively, of the Presidency. (ii) Chemical analyses of samples of clay and fine silt separated from black and red soils collected at various depths show that these fractions resemble similar fractions collected and examined from other black and red soils respectively of the Presidency. (iii) Content of exchangeable CaO also indicates that these soils are similar to other black and red soils usually met with in the Presidency.

B. Field experiments.

(i) *Old permanent manurials.*—As facilities for irrigation are not likely to be restored, utilization of this area as an experimental block will be given up.

(ii) *The new permanent manurials.*—In this experimental area field No. 45, ragi and cholam crops bearing the serial Nos. 29 and 30, respectively, were raised.

Ragi crop.—E. C. 593 was transplanted on 14th and 15th of June 1942 and harvested on 25th September 1942. (1) The western series as a whole has yielded better than eastern series,

indicating the beneficial effect of cattle manure: (2) Nitrogen does not appear to be the limiting factor, as the crop does not respond to it; (3) potash either alone or in combination with P behaves alike; but in presence of cattle manure the yield is enhanced; (4) phosphorus by itself has given the same yield as when applied in combination with cattle manure showing the absence of any interaction between the two manures.

The crop that followed this was Chitrai cholam A. S 809 Crop No. 30. It was sown on 11th March 1943 and harvested on 24th June 1943. The manuring was done on 9th March 1943 The western series has not given sufficiently higher yield over the eastern to establish definitely the influence of cattle manure. Here again N by itself does not appear to be the limiting factor. Potash by itself has given slight increase which is not felt when applied in combination with N. The most effective manure however is P, especially in the eastern series with no basal application of cattle manure.

Report of yield of Ragi crop No. 29 in New Permanent Manurial Field 45, Central Farm, Coimbatore.

Two lines were left out as outskirts and the plots cut after removal of outskirts.

Area harvested — 149 × 27 = 4·02 cents.

Manured on 12th June 1942.

Transplanted on 14, 15th June 1942.

Harvested on 25th September 1942.

Treatments.	Per plot. Dry.		Per acre. Dry.	
	Ragi grain.	Ragi straw.	Grain.	Straw.
	4 cents.			
	LB.	LB.	LB.	LB.
Eastern series—				
1 No manure ..	45	89	1,125	2,225
2 N ..	45	82	1,125	2,250
3 N + K. ..	49	92	1,225	2,300
4 N + P. ..	83	143	2,075	3,575
5 N + K + P. ..	82	158	2,050	3,950
6 K + P. ..	52	113	1,300	2,825
7 K ..	55	71	1.375	1,775
8 P. ..	67	135	1,675	3,375
9 Cattle manure ..	88	130	2,200	3,250
10 Cattle manure residual..	45	51	1,125	1,275
Western series—				
11 No manure ..	51	81	1,275	2,075
12 N ..	42	86	1,050	2,150
13 N + K. ..	46	101	1,150	2,525
14 N + P. ..	70	150	1,750	3,750
15 N + K + P. ..	86	134	2,150	3,350
16 K + P. ..	76	107	1,900	2,675
17 K. ..	73	125	1,825	3 125
18 P. ..	67	90	1,675	2,250
19 Cattle manure ..	91	139	2,275	3,475
20 Cattle manure residual..	57	70	1,425	1,750

Report on yield of Chitrai cholam crop No. 30 in field 45, Central Farm, Coimbatore.

Manured on 9th March 1943.

Sown on 11th March 1943.

Harvested on 24th June 1943.

Two lines of cholam on either side of plots were cut as outskirts and removed before plot was taken up. Area harvested = 3·75 cents.

Particulars.	Net weight of cholam grain as given to Central Farm.	Calculated net weight of cholam straw after drying.	Per acre.	
			Grain.	Calculated dry straw.
Eastern series.—	LB.	LB.	LB.	LB.
1 No manure ..	42	168	1,120	4,497
2 N. ..	32	155	853	4,134
3 N + K. ..	42	181	1,120	4,817
4 N + P. ..	82	164	2,186	4,364
5 N + K + P. ..	76	159	2,026	4,234
6 K + P. ..	58	171	1,547	4,564
7 K. ..	54	179	1,440	4,761
8 P. ..	68	190	1,813	5,067
9 Cattle manure	77	185	2,007	4,934
10 Cattle manure residual	40	154	1,067	4,095
Western series.—				
12 No manure	47	181	1,253	4,830
13 N.	49	183	1,316	4,890
14 N + K.	53	180	1,414	4,800
15 N + P.	69	231	1,840	6,170
16 N + K + P. ..	72	209	1,920	5,570
17 K + P.	57	223	1,520	5,933
18 K.	67	217	1,787	5,790
19 P.	71	231	1,894	6,220
20 Cattle manure ..	84	249	2,241	6,636
21 Cattle manure residual	54	207	1,440	5,530

Seed-bed manurial experiments with paddy.—These experiments were started to study (i) the effect of application of a liberal dose of manure in the nursey itself on the subsequent growth and yield of paddy in the transplant field and (ii) to work out the economics of it. This experiment has been in progress for the past 4 years and the results obtained so far seem to indicate that manuring at the seed bed stage is relatively more economical. The experiment was repeated during the year under report as per the original programme. The sowing was completed by 1st September 1942. The crop gave promise of good yield but the untimely and heavy rains at the time of harvest rendered harvest operation extremely difficult and hence it was decided to treat the crop as a bulk crop. The experiment will be repeated next year.

C. Plant Chemistry.

(i) *Study of quality in chewing tobacco from Jaffna and Meenampalayam.*—With a view to ascertain how the quality of tobacco is affected when the method of curing is changed, samples of Jaffna and Meenampalayam varieties of tobacco were subjected to

Meenampalayam and Jaffna methods, respectively, of curing Seedlings of both the varieties were raised in the nurseries and transplanted in field No. 60 after it had received an application of 7½ tons of farm yard manure per acre. The plants were making good growth till the stage of maturity in December, when, due to heavy rains, the crops were attacked by Black shank so severely that the entire Meenampalayam succumbed to it. To prevent the spread of infection the crop was removed and burnt as per the advice of Government Mycologist. The Jaffna variety did not completely go under Less than half the crop which survived the attack was harvested and cured by the Meenapalayam method. Samples of (1 the green plant, (2 dried plant and (3), (4) and (5) three samples during the different stages of curing were drawn for analysis. These were examined for the kind of bacteria harboured by them. The examination showed that the organisms present in both were identical and subjection of tobacco varieties to different methods of curing did not alter the kind of organisms. These consisted of (*a*) short rods or ovals, Vacuolated; present in singles, doubles or in chains, probably soil saprophytes (*b*) long thick rods, probably lactobacillus, taking an active part in fermentation of green matter; (*c*) Closeridium, probably saprophyte present in heaps due to anaerabic conditions. The work is in progress.

(ii) *Biochemical study of the changes taking place during the growth of tobacco.* – During the year under report the biochemical changes taking place during the growth of the different varities of tabacco plants subjected to tapping were studied. With this view sowing of seeds of Meenampalayam, Jaffna and Virginia varieties of tobacco was done in the nurseries on 8th August 1942 and seedlings were transplanted in field No. 60 after an application of 7½ tons of farm yard manure or 200 lb. of N per acre. The crops grew satisfactorily though at the time of harvest Meenampalayam variety especially suffered from a severed attack of 'black shank'. Samples were drawn of seedlings of 60 days old and of young plants prior to flowering of 103 days old and thereafter at intervals of a fortnight till the crop was ready for harvest on 6th January 1943 and were analysed for (i) Moisture, (ii) total N, (iii) total ash, (iv) insoluble ash, (v) soluble ash and of the water extract of the plant for, (vi) pH, (vii) total solids, (viii) organic component, (ix) inorganic components and (x) water soluble N. Distribution of N was also studied throughout the growth period at the intervals stated above. The results of analysis are recorded in Table I. The topping of the plants was done on 7th December 1942.

Biochemical changes taking place in Jaffna variety during the curing processess according to Meenampalayam method were also studied by analysing samples drawn at intervals and observing the changes in the components detailed in Table I. The results are given in Table II.

TABLE I.—*Meenampalayam, Jaffna and Virginia Tobaccos (Planted in field No. 60)—Analysis of samples taken at different stages of growth.—Results expressed as percentages per 100 gms. of dry matter.*

Seed-beds raised on 8th August 1942 Transplanted on 7th October 1942. Harvested on 26th January 1943.

Rounds.	Meenampalayam. 1	2	3	4	5	6
Age in days. (Stage of growth)	60 Seed-lings.	103 Young not flowered.	121 Flower-ing started.	136 Topped.	151 Maturing.	166 Fully matured.
	PER-CENT.	PER-CENT.	PER-CENT.	PER-CENT.	PER-CENT.	PER-CENT.
1 Moisture	91·000	91·500	89·800	89·60	90·200	83·500
2 Total N.	3·638	5·060	4·968	..	4·260	2·510
3 Total Ash ..	42·590	19·110	18·530	22·10	24·170	15·150
4 Insoluble ash ..	22·680	2·400	0·980	2·86	2·370	1·830
5 Soluble ash ..	19·910	16·711	17 551	19 24	21·80	13·320
Extracted in water—						
6 p.H.	6·0	6·2	5·6	5·7	5·6	5·3
7 Total solids ..	..	44·120	47·030	..	55·330	47·500
8 Organic solids ..	..	23·530	31·070	..	36·130	36·130
9 Inorganic solids ..	..	20·590	15·960	..	19·200	11·370
10 Water soluble N.	..	0·820	1·020	..	0·940	0·990
Nitrogen Distribution—						
11 Ammonical N ..	..	0·079	0·066	..	0·069	0·043
12 Nitrate N. ..	0·277	0·311	0·206	..	0·223	0·045
13 Amide N. ..	..	0·039	0·026	..	0·048	0·030
14 Humin N. ..	..	0.135	0·104	..	0·081	0·054
15 Diamino N. ..	..	0·081	0·081	..	0·125	0·156
16 Amino N. ..	..	0·120	0·201	..	0·105	0·034
17 Nicotine N. ..	..	0·133	0·249	..	0·483	0·344
18 Nicotine	..	0·767	1·437	..	2·793	1·980
	Jaffna.					
1 Moisture	92·000	91.010	89 600	90·700	91·300	87·300
2 Total N	3·630	4·710	4·280	..	4·312	2·790
3 Total Ash ..	41·050	20·330	17·660	21·410	24·880	17·280
4 Insoluble ash ..	19·250	3·130	1·310	3·070	4·230	2·140
5 Soluble ash ..	21·800	17·200	16·350	18·340	20·650	15·140
Extracted in water—						
6 p.H.	6·3	6·2	5 9	5·6	5·5	5·3
7 Total solids ..	..	37·330	35·120	..	48·870	50·250
8 Organic solids ..	..	23·530	21·690	..	33·910	37·820
9 Inorganic solids.	..	13·800	13·430	..	17·980	12·430
10 Water soluble N.	..	1·170	1·080	..	1·540	0·900
Nitrogen Distribution—						
11 Ammonical N ..	..	0·037	0·057	..	0·106	0·015
12 Nitrate N ..	0·190	0·289	0·306	..	0·348	0·000
13 Amide N ..	..	0·059	0·041	..	0·017	0·023
14 Humin N ..	..	0·144	0·119	..	0·091	0·073
15 Diamino N ..	..	0·073	0,090	..	0·110	0·184
16 Amino N ..	..	0·176	0·277	..	0·092	0·024
17 Nicotine N ..	..	0·138	0·190	..	0·466	0·459
18 Nicotine ..	..	0·796	1·096	..	2·696	2·658
	Virginia.					
1 Moisture	..	91·000	90·500	89·400	88·200	83·900
2 Total N	..	4·480	5·080	..	2·980	2·690
3 Total Ash ..	..	24·200	19·600	24·570	23·170	15·590
4 Insoluble ash ..	..	4·910	1·350	4·140	2.680	2·250
5 Soluble ash ..	..	19·290	18·250	20·430	20·590	13·340

Rounds.	(Virgina).					
	1	2	3	4	5	6
Age in days.	60 Seedlings.	103 Young not flowered.	121 Flowering started.	136 Topped.	151 Maturing.	166 Fully matured.
	PER-CENT.	PER-CENT.	PER-CENT.	PER-CENT.	PER-CENT.	PER-CENT.
Extracted in water—						
6 p.H	6·20	6·0	5·6	5·5	5·3
7 Total solids	40·400	44·520	..	45·020	50·750
8 Organic solids	25·500	28·320	..	31·020	39·210
9 Inorganic solids	14·900	15·200	..	15·000	11·540
10 Water soluble N. ..	0·940	1·280	..	1·007	0·720
Nitrogen distribution—						
11 Ammonical N	0·065	0·053	..	0·007	0·018
12 Nitrate N	0·252	0·256	..	0·164	0·152
13 Amide N	0·054	0·046	..	0·101	0·037
14 Humin N	0·106	0·124	..	0·053	0·062
15 Diamino N	0·080	0·078	..	0·120	0·133
16 Amino N	0·119	0·300	..	0·032	0·015
17 Nicotine N	0·125	0 300	..	0·321	0 313
18 Nicotine	0 724	0·715	..	1·856	1·818

TABLE II.—*Jaffna Curing Sample.*

Result expressed for 2000 *gms of green material.*

	Stem Leaf.					
	26th January 1943.	28th January 1943.	18th February 1943.	5th March 1943.	22nd March 1943.	27th April 1943.
Rounds.	1	2	3	4	5	6
1 Total green wt. at time of sampling.	2000·000	1330·000	510.100	335·700	262·600	303.200
2 Moisture ..	1738·000	1091·000	244·500	88·260	38·270	36·570
3 Dry matter.	262·000	239·000	265.600	248·800	224·330	266·630
4 Ash Total.	49·730	44·290	48·310	52·640	48·460	59·650
5 Ash insoluble.	3·777	3·554	3·884	5·291	3·189	6·103
6 Ash soluble.	45·953	40·736	44·426	47·349	45·271	53·540
7 Total solids.	131·500	137 200	119 300	140·900	111·900	161·400
8 Organic solids.	90·460	100·500	82·960	81·490	73·650	86·100
9 Inorganic solids.	41·040	36·700	36·340	59·410	38·250	75·300
10 Total N ..	8·976	6·290	8·015	7·986	5·580	8·307
11 Water soluble N.	3 629	3·974	4·542	4·225	3·494	4·586
12 Insoluble N	5·347	2·316	3·473	3·761	2·086	3·721
Nitrogen Distribution—						
13 Ammonical N	0·4121	0·3502	0·2948	0·1692	0·4071	0·9872
14 Nitrate N ..	0·3257	0·1633	0·2173	0·2868	0·0720	0·2747
15 Amide N ..	0·2535	0·3078	0.9274	0·3177	0·0448	..
16 Humin N.	1·4040	0·2672	0·2180	0·2353	0·2104	0·2592
17 Diamino N.	0 0611	0·5106	0·1091	0·0845	0·3926	0·9118
18 Amino N.	0·1708	0·7501	0·3910	0·7782	0·7519	0·4116
19 Nicotine N.	0·5950	0·9922	0·9346	..	0·7754	0·9800
20 Nicotine ..	3·4444	5·737	5·4030	..	4·4860	4·4980

Changes taking place during the growth period of several varieties—Moisture.—The content of moisture decreases in all varieties with age, but Jaffna retains more moisture than the other two at the time of harvest. Similar decrease is noticed in the case of total N, total ash, insoluble ash and soluble ash.

This apparent decrease in percentage is not due to loss of the constituents but to the synthesis of organic matter, mainly of a non-nitrogenous type, in greater quantity as the plant matures.

Water soluble fraction—The pH of the water extract of the plant is identified in all.

Total solids increase in all with age, but the increase recorded in Virginia and Jaffna is striking. Meenampalayam in spite of its high initial content records only 3 per cent rise. The increase in total solids is mainly contributed by organic solids and not inorganic as demonstrated by the ratios of organic/inorganic solids which are presented in the table below :—

Ratio of the organic and inorganic solids of the crop.

Rounds.	Meenampalayam.	Jaffna.	Virginia.
1	..	..	.
2	1·143	1·705	1·7.1
3	1·946	1·615	1·863
4	..	..	..
5	2·224	1·719	2·068
6	3·176	3·043	3·398 .

Water soluble nitrogen also decreases as the crop gets older for the same reason adduced above.

Topping affects only the Jaffna variety which records a slight increase after the operation. Later the percentage drops as is the case with the other two varieties.

Distribution of nitrogen.—All the fractions progressively decrease with age except Diamino and Nicotine N which increase.

The amount of Nitrate N in Jaffna variety is nil at the time of the harvest, but it contains the (largest) per cent of Nicotine N. It is possible that the plant has utilized the easily available (Nitrate) N for the synthesis of nicotine which is present in maximum amount in this variety compared to the other two.

Amide N.—Topping increases the content of amide N, the influence of which persists at the maturing stage.

The progressive decrease of all the fractions of N except the diamino N suggests that these fractions of N contribute to the formation of nicotine which progressively increases, through the diamino group. The nicotine contains both a pyridine and a methyl pyrolidine group. Jaffna tobacco when grown in Coimbatore synthesises the same quantity of nicotine as is present in the Meenampalayam variety. The analytical data do not furnish any clue for identification of any particular variety from the others, as all the three varieties contain practically the same percentage of ingredients determined.

Changes taking place during the process of curing of Jaffna tobacco by the Meenampalayam method.—The curing process consists of six stages and the samples were drawn at these critical periods and were analysed.

The process comprises—(1) Harvesting the plants in the evening at 2 p.m. and allowing them to wilt in the field for 36-40 hours. (2) Tying up the wilted plants in garlands and drying them in the open for 15 days and more till the leaves dry. (3) Stacking the dried plant (stem and leaves together) for fermentation for 10—15 days. (4) Separating the stem from the leaf and stacking the leaf and stem separately for further fermentation for another fortnight. (5) Dipping the fermented leaves in palm jaggery water and fermenting further which gives the finished product.

As the stem and leaves remain in contact for certain stages of curing it becomes quite difficult to understand as to what fractions pass from the stem to leaves and vice versa and hence both the stem and leaves are analysed separately. Such being the case calculation on percentage does not give a reliable result and hence calculation of the absolute quantities of different items present at the several stages becomes a necessity. Accordingly the two values for the stem and leaves are added up and is calculated for a total of 2,000 gms. of the green material.

During the process of curing loss occurs in (1) moisture, (2) dry matter, (3) insoluble ash, (4) total solids, (5) organic solids, (6) inorganic solids, (7) total N and (8) water insoluble N. But after dipping in palm jaggery solution and fermenting further the loss sustained by all the fractions is made up including total N. The loss of moisture is easily understood in a material which is allowed to dry but the decrease of dry matter and total solids needs explanation. If the qualities of the component 'organic solids' are followed through the process, it is observed that they suffer loss which explains the diminution noted in the two items under consideration.

Total nitrogen.—This constitutent also suffers loss mainly as ammonia.

Nitrogen distribution.—During the process there is evidence of much proteolytic activity up to the third stage after which it decreases in intensity. This inference is drawn from the fact that all the nitrogenous fractions increase up to that stage and then decrease.

Quality of Kotagiri potatoes.—This investigation was undertaken in collaboration with Government Entomologist and Government Mycologist to verify the general impression prevalent among the potato dealers that Kotagiri produce is of inferior quality compared to that of Ootacamund and Keti and that it deteriorates on keeping and in transit.

Comparative studies (physical and chemical) of potatoes raised at Ootacamund, Keti and Kotagiri indicate differences in physical properties and chemical composition as between Ootacamund and Keti on the one hand and Kotagiri on the other, even though the seed potato—Great Scot—used is the same. Early lifting of Kotagiri produce, its appreciable mealiness and possession of comparatively thicker pe l than the Ootacamund and Keti produce and ill-balanced distribution of manurial ingredients appear to be factors contributing to its deterioration in transit. Supply of manurial deficiency a d provision of æration during transit suggest themselves as possible remedies against the complaints. A separate report has been submitted for continuing the work and to study the nature of the damage sustained by the produce in transit.

Study of fodder grasses with respect to Hydrocyanic acid content.—This work was undertaken in collaboration with Lecturer in Botany for selection of grasses suitable for feeding cattle. As the common toxic principle which is present in grasses is the cyanogenetic glucoside, determination of this substance was made with 19 pure cultures to ascertain whether they contain the glucoside at all and whether any of these pure cultures contain the toxic principle and, if so, at what stage of growth they contain sufficient to prove toxic to animals. With this object 19 pure cultures were examined at four stages of growth.—(i) Tender, (ii) prior to shot blade, (iii) full bloom and (iv) after seeding for hydrocyanic acid content. Of these 19 cultures, only 4 contained hydrocyanic acid, viz., (1) Cyanodon dactylon, (2) Cyanodon plectostachyum, (3) Schima nervosa and (4) Leptochloa obtusiflora. In No. (1) only traces were present at the earlier stages of growth and later the toxic substance disappeared. The other three contained fair amounts especiall at the first two stages, leading to a decrease with advance of growth. No. (4) retains a high content even after seeding.

These four cultures have been sown in plots differently manured to study the influence of the different kinds of manures on the content of the glucoside. Actual feeding trials will also be conducted to ascertain whether in actual practice they really prove deleterious to animals when fed to them in normal amounts.

Effect of manure N and quality of irrigation water on the composition of sugarcane juice.—This investigation was taken up as a result of an observation made, viz., that canes grown in the wet lands of the Central Farm yielded jaggery of light colour whereas the canes raised in field No. 59 irrigated with brackish water from well No. 60 produced at best a brown coloured jaggery even though the juice was filtered through activated carbon as was done in the case of the former. This difference in behaviour between these two groups of canes was suspected to be due to the presence of abnormally high amounts of N present in

cases from Field No. 59. In order to substantiate the surmise information was sought on the following two points, viz., (i) whether higher amounts of N in the soil lead to a concentration of the same in the cane and its juice and (2) how the composition of the juice is affected by irrigation water of a brackish nature as compared to rain water with particular reference to the uptake of nitrogen.

To gather the required data on the above two points, 6 series of experiments with 6 pots in each series were started. The soil used was a mixture of wetland soil and Field No. 59 in equal proportions and contained 0·084 per cent of total N. The first three series of pots received N at 50, 100 and 150 lb. per acre, respectively the next two fourth and fifth series received tap water, one very frequently and the other normal quantity, but were unmanured; the last series received normal quantity of rain water and no manure. The canes were harvested and crushed and the juice was analysed for total N and its distribution in various forms. In addition certain observations on growth factors were also made such as maximum height of cane, number of cane, length of each cane, total weight of cane per plot, weight of green tops and leaves and the weight of dry leaves at the time of harvest.

The tentative conclusions drawn from the data are—

(1) The intake of N by canes is more from manured plots than from unmanured plots.

(2) The N content of juices increases with the increase in the amount of N applied as manure.

(3) The juice of canes irrigated with tap water contains more N than irrigated with rain water.

(4) Except in the rain water series there is a progressive fall in the percentage of N as the cane advances in age.

(5) The maximum difference in the content of N in juice under various treatments is noticed at the first round of analysis, i.e., at about the end of the tenth month after planting. This pronounced difference gradually narrows down thereafter and is almost negligible after 12½ months.

(6) As the high content of N in juices militates against the manufacture of a jaggery of attractive colour, it is a definite advantage to delay harvest of canes when the final product attempted is jaggery.

(7) As regards crop growth, N at 50 lb. per acre has given the maximum yield of cane and maximum number of tillers. Any further increase far from being advantageous has slightly depressed the yield.

(8) Rain water series has given the lowest yield and is also poorest in tillering capacity. Nevertheless it has given the richest juice as judged from the Brix values. Further work is in progress.

Storage changes and quality of rice.—The investigations on quality of rice as an article of food have been carried out by Dr. Srinivasan attention being mainly devoted to the phosphorus and calcium losses during the processing of the article in commerce. Storage changes have not been investigated in any detail.

These changes consist in some sort of alteration in the nature of the starch of the grain and take place slowly in the course of a ten-month period of storage. They are recognized by the market and the consumer as resulting in better digestible grades with superior cooking properties such as greatest volume on cooking with stability of grain shape.

The investigation attempts to study the nature of the changes in the quality of the starch during storage with the following results obtained during the year.

(i) The changes themselves as a single complex can be measured on a scale of volume expansions; the changes in volume with storage being measured by means of volumenometer of Jolly's type.

Variety.	Volume.		
	Immediately.	After 3 months storage.	Increase in volume.
	PER CENT.	PER CENT.	PER CENT.
G.E.B. 24.	321·7	340·7	19·0
Co 3.	222·1	260·7	28 6
Co. 8.	324·1	342·5	18·4
Co. 16.	281·3	326·0	44·7

(ii) As an alternative measure of the storage changes, the changes in viscosity of the starch of the rice grain can also be used. Viscosity was measured with hot water extracts of the rice grain powder (ground in the ball mill) by means of Ostwald's viscosimeter.

Variety.	Specific viscosity.	
	Immediately.	After 3 months of storage.
G.E.B. 24.	1·5185	1·4543
Co. 3.	1·6177	1·5618
Co. 8.	1·5940	1 5287
Co. 16.	1·5959	1·5730

There is a fall in specific viscosity of the hot water extracts.

The changes that take place in the chemistry of the starch itself have been noticed and measured by the following characteristics :—

(*a*) *Molecular size of the starch.*—The method adopted was the one used recently by Lampit et. al. for similar measurement with wheat. (Journal of Chemistry and Industry Trans. 1941 Fractionation of wheat starch by Lampit et. al). (Parts I to VII.)

Variety.	Specific viscosity.		Molecular size (yr—1/Cg)	
	Initial.	After 3 months.	Initial.	After 3 months.
G.E.B. 24 (Cold water extract).	1·0091	1·0098	0·8768	0·8742
Co. 3 ,,	1·0100	0·0097	0·9253	0·6811
Co. 8 ,,	1·0135	1·0120	1·0542	0·08092
Co. 16 ,,	1·0217	1·0231	1·4250	1·5170
G.E.B. 24 (Hot water extract).	1·5185	1·4543	11·13	10·83
Co. 3 ,,	1·6177	1·5618	12·36	11·50
Co. 8 ,,	1·5940	1·5257	11·62	10·91
Co. 16 ,,	1·5959	1·5730	11·23	11·88

The fraction of starch soluble in cold water is of low molecular weight as compared with that soluble in hot water.

(*b*) *Reducing power of the extracts* :—This is also related to the molecular size of the starch · the greater the molecular size, lower is the reducing power.

Variety.	Fraction tested.	Reducing power. Immediately.	After 3 months storage.
G.E.B. 24.	Cold extraction	503·8	483·5
,,	Hot extraction	36·5	39·2
Co.3.	Cold extraction	557·3	628·7
,,	Hot extraction	30·9	41·7
Co.8.	Cold extraction	635·6	469
,,	Hot extraction	41·1	35·9
Co.16.	Cold extraction	581·7	464·7
,,	Hot extraction	39·4	37·1

As in the case of the values for the constant $\frac{Yr-1}{Cg}$ there is a tendency for a fall in the reducing power of starch i.e., for an increase in its molecular size. The smaller sizes are more in evidence in the cold water extract.

(*c*) *Distribution of phosphorus.*—The amounts of combined phosphorus in a starch have shown to be related to (1) its molecular size on the one hand and (2) its liquefying properties on the other. This distribution was therefore studied in the various extracts of the rice starch.

Fraction.	P content (Mgms. per 100 g. of dry residue).			
	G.E.B. 24.	Co. 3.	Co. 8.	Co. 16.
1 Cold water extract	3,426	674	2,964	2,900
2 Hot water extract	436	356	512	448
3 Insoluble fraction	163	133	161	188

The insoluble portion of native starch of the rice grain contains the least phosphorus while the more soluble forms (responsible for low quality of rice) contain increasingly larger amounts of the constituent.

There is thus in rice, a form of starch with low molecular weight, high reducing power and high phosphorus content.

There is noticed a general tendency towards the formation of larger molecular sizes during the three-month period of storage.

Animal nutrition —All the Agricultural Research Stations in the Presidency except Nandyal reported favourable on the standard rations based on 'slab' system varying with intensity of work done by the animals. The trial, therefore, was repeated with six animals at Nandyal but as five out of the six animals developed foot-and-mouth disease at the early stage of the experiment, it could not be proceeded with.

Microbiology—Microbiological population of black soils.—The black soils of the Madras Presidency which are under the system of dry cultivation generally have a poor population of micro-organisms. When such a soil as at the Siruguppa Agricultural Research Station was brought under irrigation with simultaneous application of organic manures, it was observed that the population increased very much. Second round of post irrigation samples from blocks III, V, VII and VIII of the Siruguppa Agricultural Research Station were analysed for bacterial population during the year The results are represented in table below :—

Microbial population of black soils, Siruguppa (surface).
(Dry basis.)

Serial number.	Nature of sample.		Pre-irrigation.	Post-irrigation.	
	Block number.	Treatment.		First round. 1941-42.	Second round 1942-43.
			NUMBERS PER GM.	NUMBERS PER GM.	NUMBERS PER GM.
1	III	Irrigated, no manure Fd. Nos. 1 and 2.	694,000	3,350,000	1,500,000
2	V	Wet cultivation, F. Nos. 6 and 8.	656,000	3,750,000	3,130,000
3	VII	Undisturbed, weeds alone removed F. No. 1.	1,209,000	3,610,000	7,250,000
4	VIII	Garden cultivation, manured, irrigated. F. Nos. 3 to 7, 8 and 12 to 14.	571,000	4,590,000	6,550,000

These indicate that after reaching a maximum the bacterial population is getting stabilized. Block III, no manure, contains the lowest population. Block V under wet cultivation sustains the population of the previous year. Block VII which is left fallow but receiving light cultivation with a guntaka periodically and the weeds allowed to decompose on the field supports the largest bacterial population. Block VIII ranks next in maintaining a high bacterial population It is a garden land which is well manured. In conclusion it may be stated that bacterial population in a field is directly related to the nature of the cultivation it receives The following is the arrangement in the decreasing order of population as inferred from the data collected so far : (1) Fallow with light cultivation, (2) garden land, (3) wet cultivation and (4) irrigated but not manured.

Manufacture of Agar-agar from seaweed.—Agar-agar, a hemi cellulose gel, is used extensively for the preparation of bacterial and fungal media. This was manufactured exclusively by Japan from seaweed and exported to India. After her declaration as a belligerent country, the flow of trade was stemmed and India was forced to fall back on her own resources.

Experiments were started for the preparation of the substance from the seaweed, *Gracilaria lichenoides*, belonging to the Rhodophycea group found in abundance on the coral rocky south-east coast of India. After several trials the following method was worked out and adopted as it was both simple and cheap :—

The weed is first of all dried in the sun which renders it fit for preservation. The weed is then soaked in 1 per cent hydrochloric acid 30 minutes and washed free of chloride and bleached and dried in the sun. This is then repeatedly extracted with water maintained at the boiling point and the extract is incubated at 50°C for 24 hours to separate the colloidal impurities. The extract is next filtered free from these impurities and allowed to set. Then it is cut in strips and dried to yield the finished product. A sample sent to Surgeon-General to the Government of Madras has been certified to conform to the B.P. standard and to be suitable for the cultivation of bacteria. The appended table gives the analyses of the sample prepared in the laboratory as also of the imported ones for comparison.

Analysis of different samples of Agar-agar.

Serial number and particulars of sample.	Items of analysis (dry basis).			Setting power.
	Moisture.	Ash.	Nitrogen.	
	PER CENT.	PER CENT.	PER CENT.	PER CENT.
1 Hopkins and Williams shreds ..	16·90	..	0·37	2·5–3·0
2 Commercial low grade shreds ..	17·20	..	0·38	73·0
3 Serum Institute, shred (good) ..	19·72	4·13	0·29	3·0
4 Do. (bad) ..	20·53	4·45	0·39	3·0–4·0
5 Difco brand flakes	17·48	3·81	0·27	1·5
6 Prepared in laboratory crude ..	18·04	8·47	0·83	0·75
7 Extract incubated at 50°C, filtered through cotton wool.	20·76	4·91	0·44	0·75
8 Numbers 6 and 7 soaked in water, washed every day for one week solution incubated at 50°C filtered through paper No. 3.	16·09	4·86	0·17	1·5*
9 Numbers 6 and 7 soaked in water, washed every day for one week solution incubated at 50°C filtered through Chardin's paper.	12·36	3·65	0·10	..

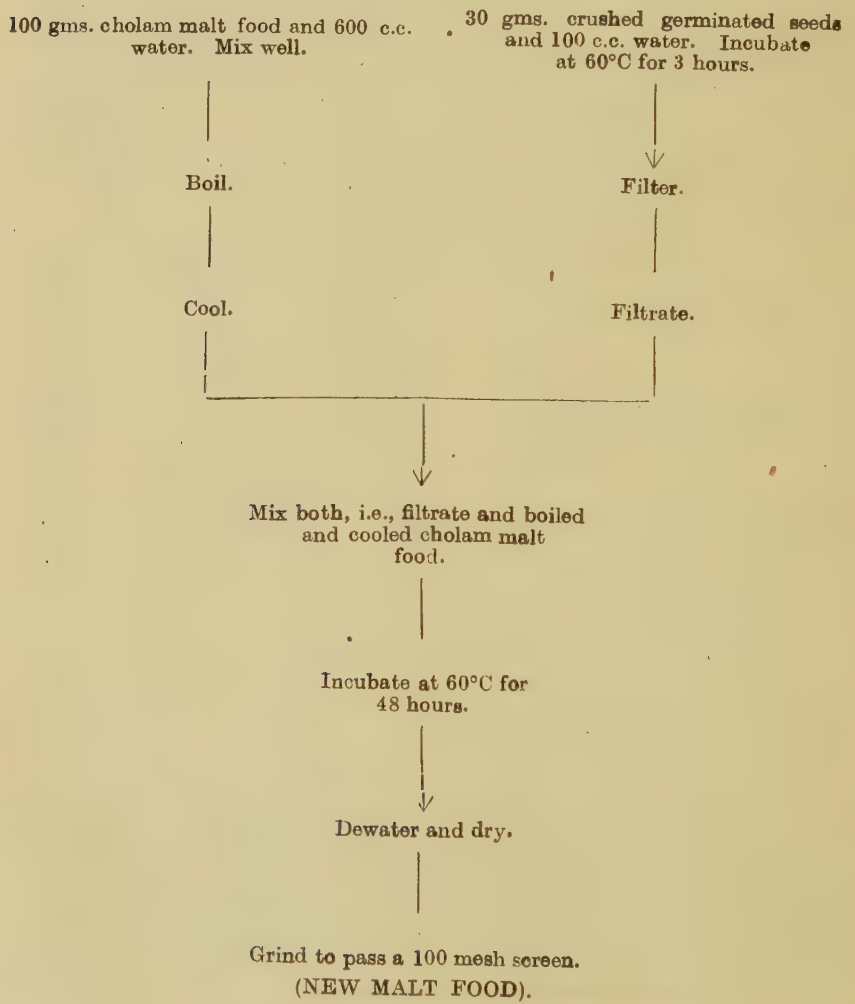
* Sample sent to Surgeon-General, Madras, and approved by him.

Manufacture of malt food on a commercial scale.—Malt food factory capable of manufacturing 36,000 lb. of malt food per annum is in operation under the direct supervision of a business manager. Plans and estimates were prepared for increasing the turnover to 100,000 lb. per annum. Building is nearing completion and the necessary plants ordered for are arriving.

Malt extract.—Large scale plant designed to produce 10,000 lb. of extract per annum is in operation. Plans and estimates to push up the production to 100,000 lb. per annum have been approved and sanctioned. Work is proceeding to equip the factory further with the required machinery.

New malt food.—Work was initiated with a view to increase the solubility of the malt food manufactured at the Government factory and to improve its aroma and taste so as to turn out a product resembling 'Horlicks Malted Milk'. The method of manufacture given below in the form of a flow sheet involves the utilization of diastase produced by germinating cholam grain for the saccharification (solubilization) of the starch present in the malt food. As a result of the above change, the solubility, the flavour and the taste of the product improve.

Flow sheet.


100 gms. cholam malt food and 600 c.c. water. Mix well.
30 gms. crushed germinated seeds and 100 c.c. water. Incubate at 60°C for 3 hours.
Boil.
Filter.
Cool.
Filtrate.
Mix both, i.e., filtrate and boiled and cooled cholam malt food.
Incubate at 60°C for 48 hours.
Dewater and dry.
Grind to pass a 100 mesh screen.
(NEW MALT FOOD).

The final product contains 60 to 70 per cent of maltose, 6 to 8 per cent of starch and 0 to 2 per cent of dextrin and tastes just like Horlicks when mixed with milk. Complete analytical data are furnished in the table below :—

Results of analysis of New Malt Food—Final product.

Serial number and heads of analysis.	Lab. No. 1122/42-43 Malt Food I.	Lab. No. 1123/42-43 Malt Food II.	Sample III.
	PER CENT.	PER CENT.	PER CENT.
1 Moisture	2·52	3·11	2·60
2 Maltose	68·61	68·61	62·97
3 Dextrin	Nil.	Nil.	2·74
4 Starch	8·52	5·90	..
5 Protein	9·23	8·85	9·14
6 Total	89·08	86·47	..
7 Lintner value (diastatic power °L.)	Trace.	Trace.	..

P. V. RAMIAH,
Government Agricultural Chemist.

DETAILED ANNUAL REPORT OF THE GOVERNMENT ENTOMOLOGIST, COIMBATORE, FOR THE YEAR 1942–43.

I. General.

I beg to submit the following report on the activities of the Entomological section for the year ending 30th June 1943.

II. Charge.

I was in charge of the section throughout the year. I also held full additional charge of the post of Assistant Entomologist for four months from 9th March 1943 when Assistant Entomologist Sri P. N. Krishna Ayyar was on leave on average pay.

III. Advisory.

During the year under review 758 enquiries were received of which 216 were dealt with by the headquarters staff and the rest by the Entomological and Mycological staff stationed in the districts. These reports mainly referred to the insect pests of crops and their control and beekeeping. The noteworthy pests which received the attention of the staff are mentioned under the item "Propaganda and Campaign."

IV. Teaching.

B.Sc. (Ag.) degree course.—Fifty-nine lectures and thirty-one practical classes were held for the first year and thirty-one lectures and thirty-two practical classes for the second year.

Short course on insect pests.—Eighteen lectures and eighteen practical classes were held in November 1942.

Short course in beekeeping.—Nine lectures and thirteen practical classes were held in February 1943.

V. Special Investigations on Crop Pests.

Pests of Cotton.

(1) *The cotton bollworms* (*Earias* spp and *Platyedra gossypiella*)—(*a*) *Regional incidence.*—Incidence of the two bollworms in the standing bolls of irrigated and dry cambodia and country cottons of the Pest and non-Pest Act areas of Coimbatore, Mathurai, Ramnad and Tirunelveli districts was determined. The seasonal incidence of the bollworms in the two areas was very low to show up the beneficial effects of the Pest Act. The general incidence of *Earias* in dry and irrigated combodias and the country cottons was low and ranged from 2·5 per cent to 6·4 per cent, lowest being in dry cambodias; that of *Platyedra* varied from 4·8 per cent to 33·8 per cent, the lowest being 11·4 per cent in country cottons. It will be seen that the latter, as usual, show very low incidence and

the " vastness " of cultivation of dry cottons may be deemed one of the factors for the incidence being maintained at a low level.

(*b*) *Incidence in shed buds and bolls.*—Incidence of *Earias* spp. was as high as 100 per cent in shed buds in December and there was an abrupt falling off by the end of January in which period production of bolls was very pronounced. *Platyedra* was absent in buds but was present in bolls with an infestation from 19 per cent to 24 per cent along with *Chloridea* and *Amorphoidea*. The initial incidence of the bollworms in bolls in January was very low (16·4 per cent) unlike that of the previous season (80 per cent).

(*c*) *Incidence in alternate host plants.*—Periodical examination of *Abutilon indicum*, *Hibiscus vitifolius* and *H. indicus* pods for borers has indicated that the latter is the most heavily and extensively infested with *Earias fabia* in the early stages and that infestation gained in acceleration as the season advanced with 132 larvae per 100 pods in November. *H. vitifolius* has given mixed infestation of both the species of *Earias* but all were *E. insulana* in *A. indicum*.

(*d*) *Larval diapause in Platyedra.*—Larval diapause was noted to occur in caterpillars picked from both the green and dry bolls of the April pickings whereas it was confined to dry bolls only of the earlier pickings of February and March. Larval diapause occurrence was most pronounced in caterpillars collected from March pickings the percentage being 33 and the maximum duration of diapause recorded was 243 days in the case of diapausing caterpillars of February pickings.

(*e*) *Ecological studies on Platyedra.*—Studies on the reaction of the different stages of the pest to exposures of varying temperatures and humidity have indicated that larvae cease to pupate and pupal development is arrested below 5°C and above 38°C and no emergence of adults results in consequence.

(*f*) *Parasites of bollworms.*—The braconids *Microbracon lefroyi* and *Rhogas aligharhensi* and an Ichneumonid were recovered from *Earias* stages. *Bassus* which used to be prominent in previous years was totally absent in the pest infesting *Hibiscus esculentus* (Bhendi), *Hibiscus vitifolius* and *Abutilon indicum*.

(*g*) *Control of bollworms by the egg parasite Trichogramma.*—For a second year in succession control of the bollworms was sought to be obtained by release of the egg parasite *Trichogramma*. In all 18 liberations of parasites were made in two fields at intervals of four days from the end of December to the middle of March at the rate of 10,000 parasites per acre per liberation. Trends of very low infestation of bollworms were observed in kapas collected and examined from the parasite released plots and they point to the beneficial effects derived from the successful control of the bollworms by the liberation of parasites. The infestation was nearly fourfold in each of the control plots.

(2) *The cotton stem weevil* (*Pempherulus affinis*)—

(*a*) *Incidence in cotton.*—Incidence of the weevil in the seasonal Cambodia crop at the Insectary, was comparatively low at the initial stages in October. Incidence however mounted up by leaps and reached cent per cent by the end of March.

(*b*) *Incidence in host plants.*—Of the nine different species of plants examined for weevil incidence, four species, i.e., *Triumfetta rhomboidea*, *Sida acuta*, *S. spinosa* and *Malvastrum coromandelianum* alone showed infestation. The highest average infestation was recorded in the first named species with 75·3 per cent as against 3·02 per cent of *Malvastrum coromandelianum*.

(*c*) *Incidence of parasitism.*—Incidence of parasitism in weevil grubs was nil in the seasonal cotton crop whereas it was 5·75 per cent in *Triumfetta rhomboidea*. *Entidon* and *Dinarmus* parasites alone were recorded on them.

(3) *The cotton leaf roller* (*Sylep'a derogata*)—*Incidence of the pest and the parasites.*—Incidence of the pest was very low this season probably due to partial failure of north-east monsoon rains. Total live stages for 100 plants did not exceed 4·44 which was the maximum recorded for the month of November as compared with 966 in December of the previous season. The pest was not in evidence after January. The table below gives the incidence:—

Month.	Per cent plants attacked.	Per cent leaves attacked.	Average live stages per 100 plants.
October	1·50	0·26	1·50
November	2·22	0·62	4·44
December	2·50	0·05	2·50
January	10·00	0·16	..

Two species of *Apanteles*, *Elasmus* sp. and *Scelio* sp. were observed in the second generation of the pest.

Control trials.—Experiments in suitably replicated randomized blocks involving the use of soap solution, Thevetia extract and Bordeaux mixture as insecticides did not bring out the efficacy of the treatments in the control of the pest presumably due to a very low incidence of the pest.

Pests of Sugarcane.

Borer pests—Imperial Council of Agricultural Research Scheme—(*a*) *Incidence of borers in cane.*—From a study of the combined incidence of the borer pests in relation to climatic factors the following trends were noted. Infestation increases after precipitation and increase is parallel to relative humidity and temperature factor does not appear chiefly to govern the increase or decrease of infestation. Such well defined relationship of weather factor is, however, not to be seen in the case of individual borers. Response of individual borers to these factors appears to be more intimately related to the stage of the crop than the

seasonal factors. The maximum infestation percentages of the different borers are as under:—

Borer.	Period of infestation.		
	May–July.	December–January.	February–March.
	PER CENT.	PER CENT.	PER CENT.
Argyria sticticraspis ..	90–100	7–12	23–40
Diatroea venosata ..	2–3	80–88	..
Scirpophaga ..	15–27 per cent in October-November.		

The incidence of the borers in the second season's crop that was raised recently is under study.

(*b*) *Varietal resistance to borers.*—Indications of a certain amount of susceptibility to individual borers are perceptible in the three varieties, i.e., Co. 413, Co. 419 and Co. 421 in certain stages of the crop but it loses its pronouncedness when the combined incidence of all the borers during the entire period of the growth of the crop is taken into consideration as will be seen from the table below:—

Variety.	Growing stage.				Harvest.			
	Argyria.	Scirpophaga.	Diatroea.	Total.	Argyria.	Scirpophaga.	Diatroea.	Total.
Co. 413	59·7	8·71	26·61	30·01	3·1	3·1	84·70	62·7
Co. 419	68·6	6·81	23·21	43·70	5·8	2·0	80·91	61·2
Co. 421	47·1	4·71	25·91	36·50	5·6	2·6	84·21	54·3

Chemical analysis of borer damaged and healthy canes however revealed that the co-efficient of purity is always high and reducing sugar content low in healthy canes.

(*c*) *Incidence in alternate host plants.*—*Sacchrum spontaneum*, *Sorghum vulgare* (cholam), *Eleusine coracana* (ragi), *Pennisetum typhoideum* (cumbu), *Zea maize* (maize), *Oryza sativa* (paddy), *Triticum vulgare* (wheat), and *Cyperus eleusinoides* were examined at periodical intervals for borers. The former was found to harbour *Busseola sacchariphaga* in large numbers and to carry infestations of *Argyria sticticraspis*, *Diatroea venosata* and *Scirpophaga*. The combined incidence never exceeded 11·8 per cent. In *Sorghum* and *Eleusine* the sugarcane borers occurred sparsely while the rest did not show up any.

(*d*) *Natural enemies of borers.*—*Xanthopimpla* and *Shirakia* sp. were recorded from borers in *Saccharum spontaneum*. *Trichogramma minutum* and *Telenomus beneficiens* were obtained from egg masses of *Argyria* on sugarcane. *Trichogrammatoidea nana* was for the first time recorded from eggs of *Argyria* and constitutes a new record for South India. *Tetrastichus* was recovered from *Scirpophaga* eggs. The following larval parasites on different borers in sugarcane were noted. *Stenobracon deesae* and *Apanteles flavipes* on Argyria; *Rhaconotus roslinensis* and *Apanteles flavipes* on Diatroea venosata; and *Rhaconotus scirpophagae*, *Stenobracon* sp., *Shirakia* sp., *Goniozus indicus* and *Elasmus zehntneri* on Scirpophaga.

(e) *Trichogramma colonization experiments (Imperial Council of Agricultural Research scheme) at Nellikuppam.*—The scheme has for its object whether by large-scale liberation of the egg parasite—*Trichogramma minutum*—increased parasitisation of borer eggs would occur and a consequential reduction of borer population would result and, whether an increase in yield of cane in the colonized plots would be obtained. The experiments were started with Co. 349 as the variety for trial under replicated plots. In all 8 parasite liberations were made from July onwards at the rate of 8,000 per acre. The results obtained in the first year were conflicting due to lack of uniformity in experimental conditions and to late commencement of the experiments. The experiments were continued for the second year overcoming the difficulties encountered in the first year. In all eight liberations were made from May onwards and four more remain yet to be done. From counts made so far definite trends are noticeable of increased parasitisation of borer eggs in the released plots and a lower incidence of borer attack in the canes of the released plots as against that of the controls.

Mass breeding of the parasite was done at Coimbatore. The parasitised host eggs glued on paper were sent to Nellikuppam by post at intervals for being distributed at convenient points inside the released plots. Studies of *Trichogramma*, the egg parasite were under study on a laboratory basis on sex ratio, host preference, time of oviposition and fecundity. In the preliminary trials on natural dispersal, the parasite was found to travel to a distance of 20 feet without the aid of winds and up to 150 feet with the help of air currents.

Pests of Chillies.

The chillies thrips (Scirtothrips dorsalis)—Varietal resistance to thrips and leaf curls.—In the second year of trial 23 varieties were tested under experimental conditions in field 19-B of the Central Farm for their resistance to thrips. Pest was not much in evidence till the middle of September. Five population counts were taken once every month up to the end of January. Population followed much the same trends observed in the previous season, i.e., rise in September and a continuous fall up to the beginning of December. Deterioration in the condition of all the varieties was noted from the end of November due to partial failure of north-east monsoon and due to rise in population from December. There was marked yellowing of foliage from which the plants never recovered subsequently. Trends for resistance in plants were not so pronounced as in last season. It was possible to classify the different varieties into six well defined groups based on the size and shape of fruits.

Pests of Paddy.

(1) *The paddy stem borer* (*Schoenobius incretellus*).—Light trapping experiments were continued for the second crop using hurricane lights only this season at Vadavanur, Palghat taluk. The light traps were set up one in each block and worked for 111 days from 5th September. The moths trapped and destroyed from the four traps were 15,481, 21,219, 21,797 and 19,862, respectively. Data on the incidence of borer in all the four 'light trap' plots and controls were collected and analysed statistically. Reduction in borer incidence was noted in the 'light trap' plots and was found to be highly significant at 1 per cent level. No significance, however, was noted in the values of incidence at different units of distances from the light upto a distance of 610 yards.

(2) *The paddy mealy bug* (*Ripersia oryzae*)—(*a*) *Seasonal incidence.*—The seasonal incidence of the pest in the three seasonal crops ranged as follows : 'Kuruvai' 1·5 per cent to 5 per cent; 'Thaladi' 5.1 per cent to 12.7 per cent; and 'Samba' 3.5 per cent to 11.7 per cent and was not so pronounced as in last season for kurvai.

(*b*) *Varietal resistance.*—The varietal resistance varied as under in Aduthurai—

Crop.	Adt. 3.	Adt. 9.	Adt. 12.	Adt. 16.	Adt. 20.	Adt. Nos. 1	2	8	11
Kuruvai ..	2·0	1·5	2·0	2·4	3·2				
Pattukkottai..	5·0								
Thaladi ..						12·7	4·1	1·0	4·6
Samba ..	11·7	(Adt. 17)				8·2			5·1

(*c*) *Control trials.*—From the experiments conducted at Aduthurai and Pattukkottai on kuruvai crop, under bulk plot conditions, trends of increased yield and low incidence of the pest were observable in all the treated plots as against their controls, thereby establishing that planting of paddy seedlings from nurseries whose bunds were scorched prior to sowing can be regarded as a good method of control in combating the 'soorai' disease. Under experimental plot conditions with kuruvai crops significance for high yield and low incidence of the pest for the treatment was obtained at 5 per cent and 1 per cent levels in one set of experiments while the results were not significant in another. In Thaladi and Samba crops trends of increased yield and low incidence were observed in bulk plots as against that of the respective controls. Trials are in progress for a second time this season.

Intermittent irrigation—(*5 days wet and 2 days dry*).—The above practice in vogue at Pattukkottai as an anti-malarial measure does not appear to increase the 'soorai' infestation as is

popularly believed. The incidence figures given below show this clearly:—

Crop.	Intermittent irrigation. PER CENT.	Normal irrigation. PER CENT.
Kuruvai Adt. 3 ...	2·0	2·2
Samba Adt. 11 ...	2·6	3·3

Pests of Fruit Trees.

(1) *The apple wolly aphis* (*Eriosoma lanigera*).—Breeding and liberation of the parasite—Aphelinus mali—was continued at the Pomological station. Control of the pest has made great headway. A uniformly high percentage of parasitisation was observed in aphids. The very low incidence of the pest in June which always used to be the peak period for the aphids would seem to indicate that the parasites have been able to check the pest to an appreciable extent.

(2) *The citrus leaf miner* (*Phyllocnistis citrella*)—(*a*) *Life history*.—Life cycle of the miner ranged from 19–25 days distributed as follows—egg 4–5 ; larva 7-9 and pupa 8-10 days. The miner larvæ start mining into the leaf exactly from the spot where the egg was laid. When they are full fed they improvise sockets in the margins of leaves in which they pupate one in each and emerge as adults in due course.

(*b*) *Natural enemies*.—The stages of the pest are attacked by two different chalcid parasites.—one attacking the larval and the other pupal forms within the mines. The incidence of parasitism was never pronounced.

(*c*) *Incidence*.—Infestation usually starts within a week after the tender leaves have sprouted. Incidence of the pest was light from April to November and severe in January and February in Coimbatore.

(*d*) *Control trials*.—Of the several insecticides like sulphur dust, tobacco dust, Thevetia extract, gingelly oil emulsion, nicotine (0·05 per cent) and tobacco extract that were tried nicotine alone proved promising.

(3) *The grapevine flea beetle* (*Scelodonta strigicollis*).—(*a*) *Habits*.—The adult beetles cause damage to fruiting and vegetative sprouts that develop within 7-12 days after pruning of the vines and thus make them unproductive. Females lay eggs singly or in clusters on or slightly below the surface of the soil. Each female is capable of laying an average of 250 eggs. The grubs hatch in 4 days and live for 40 to 45 days in the soil feeding on the underground stem and pupate in small mud chambers. The adult beetle finally emerges 7-8 days after pupation.

(*b*) *Control trials*.—Trials with insecticides like dusts of calcium arsenate plus lime, sulphur and sprays of Bordeaux mixture (1 per cent) involving three applications repeated at intervals

have shown that the former was better than the rest as regards the control of the pest.

Pests of Gingelly.

The gingelly caterpillar (*Antigastra catalaunalis*).—Due to extreme low incidence of the pest at Tindivanam this season dusting and spraying trials on a randomized block lay out with Thevetia extract, ground nut oil emulsion and calcium arsenate dusting on the most susceptible variety S:I:6-2-133—1 did not give significient control of the pest.

Pests of Castor.

The castor semilooper (*Achaea janata*) *Euphorbia hirta* and *Tridax procumbens* were found to be the only alternative host plants noted so far. Field parasitism of the parasite complex in the host caterpillars during the first week of November ranged as under.

Date.	Per cent parasitisation due to		
	Rhogas.	Mieroplitis.	Hymeno-bosmina.
2nd November 1942 ..	7·4	62· 4	2· 7
3rd November 1942 ..	6·4	37·74	0· 8
4th November 1942 ..	8·7	29· 1	0·09
5th November 1942 ..	5·6	36· 3	0·22

Two varieties of *Trichogramma* egg parasites yellow and dark forms were found parasitising the host eggs in the field even early in the season. The former predominated in numbers and the field parasitism due to the parasites was kept as high as 90 per cent in October. As these breed readily in Corcyra eggs these are being multiplied on a large scale for utilizing them in the control of the pest early in the coming season. Spraying with Thevetia, castor, neem and groundnut oil emulsions was found effective against the caterpillars.

Pests of Coconut.

The coconut beetle (*Oryctes rhinoceros*) *Biological control.*—Field trials in pits are being continued with green muscardine fungus. Fungus affected grubs were recovered from the Insectary pits all the months. At the coconut stations grubs in the newly modelled treated pits showed signs of fungus infection at Nileshwar II from July to October, Nileshwar III from July to February and at Kasargod for six months. Pilicode did not record any infection of grubs so far. Periodical addition of fresh cattle manure would appear to be necessary to make the pits more attractive for the beetles to come and lay eggs.

Pests of Vegetables:

(1) *The brinjal budworm* (*Phthorimea blapsigona*).—*Nature of damage.*—The caterpillars bore into the flower buds at a very early stage and damage the ovaries very extensively long before

the flowers open out normally in due course with the result they are shed sometime after.

Incidence of the budworm.—The incidence was very pronounced in the months of January and February and March in crops planted in September. As high as 73 per cent of the standing buds were found damaged. The incidence was slightly more in the month of March in the shed buds: it varied from 45·3 per cent to 85.4 per cent.

Incidence of field parasitism.—The caterpillars were heavily parasitised in the field by Microbracon gelechidiphagous Parasitisation ranged from 32·8 per cent to 98 per cent. Despite this high check exercised by the parasite the buds continued to be badly infested with worms.

Biology of the pest.—The female moths lay eggs at night; the eggs are laid singly on the tender surface of the leaves along the course of the main and subsidiary veins. Tney are creamy white in color but develop dark spottings when they are just about to hatch; hatchlings emerge after a week. Larval period varies from 9-12 days and pupal period from 8—10 days.

Control trials.—Application of three insecticidal treatments—sulphur dust, nicotine spray (0·05 per cent) and calcium arsenate plus lime spray ($\frac{3}{4}$ oz. to 5 gallon) in two rounds in replicated plot conditions have shown that calcium arsenate and lime was the only treatment whereunder satisfactory control of the pest was obtained.

(2) *The potato tuber moth* (*Phthorimea operculella*).—*Incidence of the pest.*—Of late reports of increased damage to potato tubers by the tuber moth in storage were received from potato growing tracts in Nilgiris. The tuber moth damage varied according to locality—Ooty tract 7·52 per cent; Kotti 16.66 per cent and K tagiri 50 per cent.

Control trials.—Preliminary trails at Coonoor with insectidal dusts like Pyrethrum, Derris, Acorus and tobacco have shown some promise in the control of the moth. Therefore regular experiments with the same insecticides have been started with suitable replications at the Agricultural Research station, Nanjanad.

Pests of Wattles.

The fluted or the wattle scale (*Icerya purchasi*)—(*a*) *The present position of the scale in the Upper Palneys. Kodaikanal taluk.*—Spread of the pest to new areas like Thaikal, Gorapoor, Shembaganoor, Perumalmalai, Kilvarai, Kemboor, Polu, Marianshola and Kukkal was noted. It was observed to occur in fairly severe proportions in the old tracts like Kodaikanal, Poondi, Mannavanoor, Kavinji and Poombarai prior to liberation of the predatory beetles. Slight subsidence of the pest is observed in areas where systematic liberation of beetles was being done.

(*b*) *Alternate host plants.*—So far 29 alternative host plants were recorded in Upper Palnis carrying infestation of the scale; the *Acacia* spp., *Helichrysum bracteatum*, *Hypericum mysorensi* and *Citrus* spp., being the more easily affected and preferred:

(*c*) *Breeding and liberation of the predatory beetle—Rodalia cardinalis.*—Breeding was brisk in warmer months but slowed down in wet and chill months. Out of a total of 12,415 adult beetles bred so far 5056 beetles were liberated in different badly infested areas in small batches of 100-300 at intervals. As a result of the continued liberation of the beetles marked signs of the pest being brought under control were seen in areas such as Mannavanoor, Poondi, Kavinji and Berijam where the pest was previously very severe. The breeding scheme has been extended for another year from 22nd May 1943. A Rodolia breeding scheme has been also sanctioned for Nilgiris with headquarters at Fernhill

(*d*) *Enforcement of the Pest Act.*—By a notification under the Pest Act enforcement of cutting and burning of the badly affected *Acacias* was carried out over an area of 3·02 acres of badly infested wattles scattered in the villages of Kavinji, Poondi and Poombarai.

(*e*) *Life history study of the pest and the predator.*—The scale insect was found to pass through three generations in a year. As many as 1,409 nymphs emerged from the egg sac of a single adult scale. The predatory beetle was able to pass through seven generations within a year under laboratory conditions. The period taken to complete one generation ranged from 37–51 days. Maximal longevity and fecundity for a single female worked out at 129 days and 897 eggs. Egglaying commenced usually after a preovipositional period ranging from 3–12 days.

Other local predators like R. *roseipennis* and the caterpillar *Stathmapoda* sp., were in evidence but the control exercised by them on the scale was poor:

Pests of Stored Products.

(1) *The cholam grain weevil* (*Calandra oryzæ*),—(*a*) *Control trials.*—The experiments with seven treatments consisting of (1) Acorus dust, (2) air slaked lime, (3) air slaked lime and creosote (4) wood ash, (5) pyrethrum, (6) quarterly sun drying, and (7) control were concluded. The treatments were tested in 25 lb. bags of grain, each with the addition of ½ lb. of the appropriate chemical, replicated four times. Acorus proved superior to the rest of the treatments in giving lowest number of live beetles and lowest percentage of loss of grain and did not affect the cooking quality or the germination of the grains.

In cholam grains kept in bottles, Acorus was found equally effective as Naphthalene against weevil attack. Since the former is more easily available now and less costly it can be used as a substitute for the latter.

(*b*) *Varietal resistance.*—Of the 20 selections of cholam seeds obtained from different stations and tested for their relative susceptibility to *Calandra* attack none were found immune.

The loss in weight was the lowest in As. 4621 (21 per cent) and highest in As. 389 (62 per cent).

(c) *Survey of pests of jowar and methods of storage Indian Council of Agricultural Research Scheme.*—Studies in the incidence of the pests affecting cholam and the different storage practices were concluded. Pit storing for foodgrains was found to be most common in Coimbatore, Ceded parts of Guntur, Krishna and Mathurai districts. The grains in the pits were fairly free from insect attack. Grains for seed purposes were commonly stored in gunnies and dried periodically and the average incidence never exceeded 4 per cent, the maximum being 36 per cent. Among the pests noted *Calandra* was more prominent in Coimbatore zone, *Rhizopertha* in Bellary zone and both of them in Guntur zone.

Under laboratory conditions, the life cycle of *Calandra* ranged from 31–42 days. The weevil developed rapidly in whole grains less so in the brokens and there was practically no development in the powder.

(2) *The rice weevil in stored raw and par boiled rice.*—Large-scale experiments with raw and par-boiled rice of different grades of polish were started to test their susceptibility to insect attack. Fortnigtly observations on the incidence of insects in the two kinds of rice are being made.

Rats and their control.

Trials against two species of rats.—Rattus rattus rufescens and R. rattus wroughtoni.—with different poison baits have indicated that Barium carbonate, paris green, calcium arsenate, electric paste (a proprietary preparation) and milk of *Calotropis gigantea* were lethal at appropriate doses while cement, nerium root, nerium leaves and glass powders gave negative results when given mixed with rice polishings or bran. Baits with Thevetia pulp however were never accepted perhaps due to its deterrent action.

VI. Insecticidal Studies.

(*a*) *Indigenous*—(1) *Thevetia neriifolia.*—Studies on this insecticide were continued. Trials made against different insect pests have once again shown that Thevetia extract is a powerful contact insecticide and a deterrent. It had no action as a stomach poison against a few of the insect pests. No appreciable deterioration in toxicity against insects was noted in seeds kept stored for about one year.

(2) *Acorus.*—Further trials have shown that aqueous infusions at a strength of 1 oz in one gallon of water plus 1 oz. of soap are highly toxic to Epilachna grubs, Eupterote and Parasa caterpillars, aphis on lablab, cowpea, brinjal, cotton and snakegourd and castor mites. Acorus powder was found to be a good preservative for woollen fabrics against the clothes moth ; it was also effective on bird lice on poultry.

(3) *Vegetable oil emulsions of castor, neem and groundnut.*—The above emulsions when sprayed at a strength of ½ oz. in one gallon of water plus equal quantity of soap gave satisfactory kill against *Achœa* and *Plusia* caterpillars, Tingitids on brinjals and *Empoasca* sp. Extracts of *Sapindus emarginatus* was found to be a good emulsifier. Kernel extracts of these oil seeds were not as effective as their oil emulsions.

(*b*) *Exotic—Derris elliptica.*—Dusts were found effective against cotton aphis. Attempts made to cultivate this non-poisonous but highly insecticidal plant in Coimbatore have been successful. Cuttings have been sent to various Research Stations to find their suitability for cultivation.

Pyrethrum powder has given satisfactory control of bird lice on poultry.

(*c*) *Fumigation trials.*—Tests with calcium cyanide A dust have shown that at the rate of 3 lb. per 1,000 cubic. feet. of space and an exposure of 24 hours gave high kill of adults of *Calandra* and *Rhizopertha*.

VII. Life History Studies and Pest Control Work at Headquarters.

At the insectary the life history and habits of the insects collected at headquarters and those received from outside were studied. A few of the more important insects which received attention are given below :—

(1) The grapevine flea beetle—*Sceledonta strigicollis* ;

(2) The redgram pod borer—*Exelastes atomosa* ;

(3) The brinjal budworm—*Phthorimoea blapsigona* ;

(4) The groundnut store beetle—*Dermestes cadaverinus* ;

(5) The mango shoot webber—*Orthaga exvinaceæ* ;

(6) The stored cholam pests—*Calandra*, *Rhizopertha* and *Tribolium* ;

(7) *Trichogramma* sp.—an egg parasite of the castor semi-looper.

(8) *Trichogrammatoidea nana*—an egg parasite of the sugarcane borer (Argyria) ;

(9) *Rodolia cardinalis*—a predator on the wattle scale (*Icerya*) ;

(10) *Microbracon* sp.—a parasite of *Adisura atkinsoni* and *Maruca testulalis* ; and

(11) *Elasmus* sp., *Apanteles* sp., and *Scelio* sp.—parasites of the cotton leaf roller.

The control of the pests reported from the Central Farm, breeding stations and villages in the vicinity of the college was attended to. Some of the important pests dealt with were Epilachna on brinjal, Rhinoceros beetle on coconuts, Parasa on mango,

Plusia on snakegourd, Psyllids on curry leaf, aphis on cowpea, bhindi, snakegourd, bottlegourd, lablab, blackgram, orange, brinjals and *Cryptostegia grandiflora*, Aleurodids on rose, Agromyza on beans, jassids on lablab, white-ants on sugarcane, red-ants in flower beds, mites on castor and curry leaf, houseflies at the malt factory, fleas in buildings and rats in the field.

VIII. Bee-keeping.

(*a*) *Apiary.*—Throughout the year the Apiary had an average strength of 40 colonies. From July to September the weather and pasturage were not favourable. By October however there was improvement as a result of the heavy rainfall received during the month. The conditions were quite favourable from November to February. There was normal activity for the rest of the period. The maximum record of honey for a single hive was 13 lb. as against 10 lb. 10 oz. of the previous year.

(*b*) *Research.*—Research on various aspects of bee-keeping showed progress—

Bee enemies—The yellow banded wasp.—Vespa cincta was very active from June to August and control measures had to be undertaken to reduce its attack.

Swarm prevention.—Interchanging of positions of colonies with strong tendency to swarm with those of weak colonies controlled the swarming instinct in the former.

Pollen substitutes.—These studies were made in July when the pollen yielding plants were scarce. A mixture of $\frac{1}{8}$ oz. bengalgram flour and 1 oz. of honey was found to have beneficial effect on brood rearing.

Bee pasturage plants.—The following plants are new records for Coimbatore : *Cyperus rotundus* (Pollen) in October; *Alangium salvifolium* (nectar) in March and *Gliricidium maculata* (nectar) in March.

Longevity studies.—These were made by marking the bees. The maximum longevity of the worker bees in five trials were 49; 49; 54; 54 and 44 days, the nurse bee periods being 11; 11; 12; 12 and 12 days respectively. The maximum longevity of the drones was 56 days in April-May.

Flight range of bees.—For this study also the bees had to be marked. In July 1942 the maximum distance observed was $3\frac{1}{2}$ furlongs; in April 1943 when plenty of cane juice was available the maximum distance traversed by bees was $8\frac{3}{4}$ furlongs.

Selection as a method of improving the colonies.—Out of the ten colonies selected for their good performance four showed more desirable traits than the others in their capacity to resist adverse pasturage and weather conditions in better honey yield and less tendency to swarming. Observations have to be continued for another season when attempts will be made to queen the colonies with the progeny of these bees.

Viscocity of honey.—It has been found possible to increase the viscocity of honey by devacuating and dehydrating under a vacuum.

Preservation of honey.—Honey from sealed and unsealed cells, both ripened artificially and unripened was stored in bottles for 13 weeks. On examination it was seen that unripened honey from sealed and unsealed cells was fermented while the ripened honey from sealed and unsealed cells was not fermented.

(c) *Propaganda.*—The following table shows the number of hives in the Presidency in the years 1936 to 1942 :—

1936—1,708 ; 1937—1,756 ; 1938—2,892 ; 1939—4,323 ; 1940—5,999 ; 1941—7,530 and 1942—8,749.

It will be seen from the figures that bee-keeping as a cottage industry is gaining popularity. This is due to the propaganda work done by the department. Bee-keeping exhibits at the different exhibitions continued to interest the visiting public. Short course in bee-keeping was held in February. The 'Honey Week' was celebrated throughout the Presidency. At Coimbatore it was inaugurated by Doctor Scudder, District Medical Officer, at the Government Training School for Women on 5th March 1943. In connexion with this, a bee exhibition was held for 3 days. A radio talk on bee-keeping and the publication of bee calendar containing hints on bee-keeping for every month formed new features for this year.

IX. Quarantine Service.

A notable achievement under this head was the execution of large-scale fumigation of insect infected Australian wheat stocks in the godowns in Madras, with cyanorgas—A dust at a concentration of 3 lb. per 1,000 cubic feet. Wheat samples were found infested in varying degree with *Rhizopertha dominica, Calandra oryzæ, C. granaria, Tribolium castaneum, T.* sp., *Silvanus surinamensis, Læmophlœus* sp., beetles and *Plodia* caterpillars. Damage to grains was most severe and pronounced where the former occurred in predominant numbers. Fumigation of wheat packed in gunny bags was 'in situ' by the conversion of storage godowns into temporary fumigatoria and delivering the gas laden dust through multiple inlet pipes under high pressure generated by the air compressed machine. A uniform dispersion of the dust inside the room was secured with the help of 'gunnitting' machine that was adapted to blow in the dust. After an exposure of 24 hours, 'degassing' was done with the aid of powerful air blowers to remove the hydrocyanic acid gas from different pockets. Natural aeration was allowed in subsequently to drive out the gas completely. Samples of fumigated wheat were often drawn for making numerical estimations of insect kill and for determining by chemical analysis the residual HCN gas absorbed by the grains. Estimation of insect population by the ingenious 'Carbon dioxide index' method showed the insect population was totally destroyed

It will thus be seen that all these elaborate operations formed part of a complicated and arduous technique that had to be devised on the spot to suit the local conditions. This is the first instance where an undertaking of this magnitude has been taken up. About 5,000 tons of wheat comprising of 50,000 bags were successfully fumigated by this method and grains saved from further damage that would have otherwise certainly occurred if no fumigation had been done. An equal volume, namely, 50,000 bags remain yet to be fumigated. The grains were not released for distribution until the Government Analyst had issued a certificate to the effect that the fumigated grains were free from traces of HCN. This work was done in colloboration with the Public Health department

In addition, 18 lots consisting of seeds, plants and bulbs received from and intended for despatch to countries abroad were fumigated where necessary and pest-free certificates issued.

X. Systematics and Collections.

Systematic studies with special emphasis on parasitic Hymenoptera (Chalcidoidea) and Termitidae were continued. *Trichogrammatoidea nana* on eggs of sugarcane borers, *Trichogramma* spp. yellow and dark forms on eggs of *Achœa* and *Tetrastichus ovularum* on eggs of Epilachna constitute the first records for South India. No foreign sendings were possible to be despatched under the present war conditions. Nevertheless one consignment of named insects sent for identification previously was received back from the Imperial Institute of Entomology, London. One consignment of insects was duly received back named from the Imperial Entomologist, New Delhi. Specimens in the general mixed collections belonging to the order Coleoptera were sorted out into families. A paper on a new pupal parasite *Trichospilus diatræœ* was written up for publication. A new Sphegiogasterid parasite was recorded from beetles affecting stored cholam.

XI. Propaganda and Campaign.

Demonstration of new and well-known remedial measures against insect pests and the popularization of the beekeeping industry formed the chief items under this head. The staff were in charge of the Pest Act operations connected with the eradication of the hairy caterpillar and the cotton stem weevil and participated in all the principal exhibitions. Problems peculiar to different tracts received special attention as time permitted.

Vizagapatam.—The Entomology Assistant attended to the following pests: the swarming caterpillar, stem borer, leaf roller and the gallfly of paddy, the citrus fruit sucking moth and the red hairy caterpillar (Amsacta).

East and West Godavari.—The chillies thrips, Nephantis and Natada on coconuts, mites on citrus, Prodenia and aphids on tobacco, thrips on onions and garlic and Spodoptera, Hispa,

Pachydiplosis and Cirphis albistigma on paddy were the more important pests tackled by the Entomology Assistant stationed at Samalkot. Work on bee-keeping showed considerable progress in these two districts.

Kistna and Guntur.—The Mycology Assistant stationed at Masulipatam (later transferred to Guntur) was engaged in the demonstration of remedial measures against pests like Rhinoceros beetle on coconut, fruit sucking moth and bark eating caterpillar of citrus and stem borer of paddy.

Cuddappah and Anantapur.—The following pests were tackled by the Entomology Assistant stationed at Cuddappah. The chillies thrips, aphis and Epilachna on brinjals, the citrus fruit-sucking moth and leaf miner ; termites on sugarcane ; rhinoceros beetle on coconut, the pumpkin beetle (Aulacophora) ; Laphygma and thrips on onions ; aphis and fruit flies on melons ; and the grapevine flea beetle. A few observations were also made on the cattle fly *Stomoxys.*

Bellary and Kurnool.—The red hairy caterpillar (Amsacta), the mango hopper, the pink bollworm, chillies thrips and the surface grasshopper (Chrotogonus) were some of the pests tackled by the Mycology Assistant stationed at Bellary.

Madras, Chingleput and Chittoor.—In addition to bee-keeping work the Entomology and Mycology Demonstrators stationed at Saidapet attended to the control of the following pests: the sugarcane borers, Epilachana on brinjal, Nephantis on coconut and aphis on vegetables.

Tanjore and Trichinopoly.—The following were some of the pests which received the attention of the Mycology Demonstrator stationed at Tanjore : the mango hopper, the red palm weevil (Rhynchophorous), the sugarcane borers, Leptocorisa and Ripersia on paddy, Epilachna and mites on brinjal and the agathi weevil (*Alcides bubo*).

Madurai, Ramnad and Tinnevelly.—The grapevine flea beetle, the red hairy caterpillar on groundnut, the chillies thrips, the citrus caterpillar (Papilio), the mango hopper and the mango stem borer and Leptocorisa on paddy were some of the more important pests tackled by the Mycology Demonstrator, Madura. He also attended to bee-keeping and fumigation work.

North Arcot, South Arcot and Salem.—The Mycology Demonstrator at Vellore, in addition to the bee-keeping work, was engaged in the demonstration of control measures against aphis on beans and chillies, Nephantis on coconut, the agathi weevil and the grapevine flea beetle.

Malabar and South Kanara.—Mass breeding and liberation of parasites was done by the Mycology Demonstrator at Calicut for the control of the coconut caterpillar, Nephantis Serinopa in the two districts. He also demonstrated remedies against the paddy

swarming caterpillar *Spodoptera mauritia* and rats infesting tapioca.

Coimbatore and Nilgiris.—Propaganda work in these two districts was attended to by the headquarters staff. The more important of the pests tackled were the apple woolly aphis (*Eriosoma lanigera*), the wattle scale (*Icerya purchasi*), aphis on lablab, brinjal and bhendi, the coconut caterpillar (*Nephantis serinopa*), the stored grain weevil (*Calandra oryzæ*), the guava scale (*Pulvinaria psidii*), the gingelly caterpillar (*Antigastra catalaunalis*), the castor slug (*Parasa lepida*), *Ripersia* sp., on ragi, *Plusia* sp. on snake-gourd and white ants infesting sugarcane. Exhibits were supplied to various exhibitions in the different districts in the Presidency.

XII. Scientific Papers Prepared.

The following papers were prepared during the year :—

(1) The preliminary trials with Trichogramma parasite for the control of cotton bollworms in Coimbatore.

(2) The sweet flag (Acorus calamus)—a source of vegetable insecticide.

(3) Preliminary trials with oil emulsions for the control of insect pests.

(4) Orthaga exvinaceae—a pest of mango.

(5) Trichogrammatoidea nana—an egg parasite of sugarcane borer Argyria sticticraspis.

(6) The parasite complex of the castor semilooper—Achaea janata.

(7) Elasmus brevicornis as an efficient factor in the control of the cotton leaf roller.

(8) Identity of Microbracon brevicornis and Microbracon hebetor.

(9) A leaflet on Thevetia neriifolia—a potent new insecticide.

(10) A series of hints on bee-keeping for the months from January to June 1943.

(11) Two radio talks on the "Mango hopper and its control" and "The coconut beetle and its control".

The first eight papers were presented at the Entomology and Zoology sections of the Indian Science Congress held at Lucknow in January 1942.

Coimbatore,
29*th August* 1943.

M. C. CHERIAN,
Government Entomologist

DETAILED ADMINISTRATION REPORT OF THE GOVERNMENT MYCOLOGIST FOR THE YEAR 1942-43 (FASLI 1352).

I was in charge of the Mycological section and the Microtome section during the year under report except for a period of one and a half months from 22nd September 1942 forenoon, when Sri D. Marudarajan was officiating from 22nd September to 6th November 1942 during my absence on leave.

The activities of the section are classified and reported on under the following heads :—

I Mycological research.
II Virus diseases research.
III Work on phanerogamic parasites.
IV Quarantine service and legislative measures.
V War effort.
VI Propaganda.
VII Teaching.
VIII Advisory work.
IX Microtomy.
X Miscellaneous.

I. Mycological Research.

1. *Rice 'blast'* (Piricularia oryzae)—*Studies on varietal resistance.* Seventy-three cultures of paddy kindly supplied by the Paddy Specialist were tested for their relative resistance to *Piricularia* under field conditions in the Central Farm at Coimbatore. The cultures tested were as follows :—

Description of varieties.	Number tested.
Selections from crosses of Co. 4 × Adt. 10	16
Do. G.E.B. × Adt. 10	4
Cultures from Agricultural Research Station, Buchireddipalem	50
Standard strains	3
Total ..	73

The nursery was raised during August and transplanting was done in September. The varieties were transplanted in strips of two ten-feet rows, each one foot apart, interstripped with a single row of the highly susceptible Adt. 10, which taking infection

earliest acted as source of infection to adjacent rows. A belt of this variety surrounded the experimental area The layout was of the randomized block series replicated four times. The incidence of the disease was noticed on the variety Adt. 10, a week after planting, and infection spread to other varieties gradually up to the end of October, when conditions were favourable for the spread of the disease. After this period there was no further spread of infection.

Periodical observations on leaf, node and neck attack by *Piricularia* were made and recorded. The dates of the emergence of the flag leaf and the panicle were noted for each variety.

The results of the observations are recorded below :—

TABLE I.—*Showing percentage of neck infection caused by* Piricularia oryzae *in the varietal plots in the year* 1942–43 (73 *cultures*).

Serial number	and culture number or name.	Percentage of infection.	Serial number	and culture number or name.	Percentage of infection.
1	G.E.B. 24	0	38	3912	4·57
2	1223	0·59	39	2515	4·61
3	3883	0·84	40	2552	4·67
4	3895	1·00	41	1955	4·81
5	2366	1·06	42	4067	4·99
6	3842	1·20	43	3911	5·25
7	2617	1·41	44	1979	5·34
8	3839	1·45	45	2507	5·41
9	3841	1·60	46	1418	5·46
10	2364	1·62	47	3906	5·54
11	3941	1·66	48	4072	5·77
12	1835	2·01	49	1284	6·07
13	1283	2·23	50	2588	6·07
14	3942	2·39	51	1942	6·09
15	2744	2·41	52	1484	6·43
16	2380	2·56	53	1952	6·52
17	4070	2·59	54	2713	6·53
18	3919	2·63	55	2811	6·69
19	3892	2·69	56	2554	6·81
20	3931	2·83	57	2559	6·91
21	3840	2·84	58	2488	7·53
22	1363	2·89	59	2202	7·56
23	Co. 4	3·23	60	4349	7·67
24	2381	3·33	61	1508	8·03
25	2566	3·40	62	2576	8·13
26	1349	3·48	63	2501	8·20
27	4005	4·49	64	2423	8·27
28	2619	3·50	65	3937	8·32
29	2367	3·52	66	2486	8·89
30	2475	3·89	67	2799	8·95
31	1834	4·00	68	2465	9·04
32	3832	4·04	69	1914	9·33
33	1435	4·08	70	2405	9·86
34	1455	4·11	71	2526	9·96
35	2042	4·25	72	1984	10·77
36	2555	4·51	73	Adt. 10	20·85
37	2530	4·53			

Adt. 10 the check variety showed 20·9 per cent infection, the maximum incidence recorded during the year as against 75 per cent recorded for this variety in the previous year, indicating that the seasonal conditions during the year under report were not

favourable for high incidence of the disease and hence the results regarding varietal susceptibility obtained this year are not to be regarded as the highest incidence obtainable in normal seasons.

2. *The cause of breakdown of resistance in G.E.B.* 24.—The strain of paddy G.E.B. 24 had, for a number of years, been considered as highly resistant to *Piricularia* attack, based on the observation of its behaviour in the varietal test plots and elsewhere. But in recent years the strain has failed to stand up to its reputation, and investigation on this aspect was taken up on hand during the year.

Nitrogen as a factor.—With a view to find out if the application of increasing quantities of nitrogen to the soil induces increased susceptibility to *Piricularia* in plants grown in it, an experiment was carried out on the following lines :—

Thirty pots (12' × 12") were filled with equal quantities of pulverised and sieved paddy soil and the lot was divided into five series of 6 pots each. Four levels of ammonium sulphate to represent 1 N, 2 N, 3 N and 4 N doses of nitrogen were added to four series, respectively, and one series was left as control. The pots were buried in randomized block arrangement in a paddy field transplanted with the variety Adt. 10 In the pots seedlings of G.E.B. 24 were transplanted. Counts of leaf, node and neck infection were taken. As the incidence of the disease was very low in all the series the experiment did not furnish any data for drawing any definite conclusions.

3. *Comparative studies of Piricularia sp. isolated from different hosts.*—(*a*) *Spore measurements.*—*Piricularia* isolated from paddy and ragi were inoculated on leaves of the respective hosts in sterile tubes, and allowed to sporulate under identical conditions and measurements of the size of 200 spores were made under the oil immersion lens.

The results are as noted below :—

	Paddy Piricularia.		Ragi Piricularia.	
	Breadth.	Length.	Breadth.	Length.
Range ..	9·13μ to 14·11μ	21·58μ to 32·37μ	9·13μ to 14·11μ	18·3μ to 29·9μ
Mode ..	11·12μ	24·9 μ	11·62μ	24·9μ
Mean ..	11·58μ	26·35μ	11·37μ	23·7μ

(*b*) *Physiological studies.*—(1) The amount of mycelial development as estimated by the gravimetric measurement of the mycelial mat was determined when *Piricularia* isolated from paddy, ragi, tenai and *Digitaria marginata* were grown in the following nutrient solutions and decoctions :—(*i*) Richards' solution, (*ii*) Brown's solution, (*iii*) paddy leaf decoction, (*iv*) ragi leaf decoction, (*v*) tenai leaf decoction and (*vi*) standard solution.

TABLE II.—*Showing dry mycelial weights after 20 days' growth in 50 c.c. of the medium at 37° C.*

Medium.	Paddy Piricularia.	Ragi Piricularia.	Tenai Piricularia.	Digitaria Piricularia.	Total.	Mean.
	GRAMS.	GRAMS.	GRAMS.	GRAMS.		
Paddy decoction ..	0·0145	0·0171	0·0160	0·0185	0.0661	0·0165
Ragi decoction ..	0·0150	0·0184	0·0176	0·0199	0·0709	0·0177
Tenai decoction ..	0·0760	0·0764	0·0705	0·0723	0·2952	0·0738
Richard's solution ..	0·0085	0·0098	0·0090	0·0052	0·0325	0·0081
Brown's solution ..	0·0053	0·0036	0·0059	0·0023	0·0171	0·0043
Standard solution ..	0·0189	0·0161	0·0217	0·0204	0·0770	0·0193
Total ..	0·1382	0·1414	0·1407	0·1386		
Mean ..	0·0230	0·0219	0.0235	0·0231		

It would appear from the above that all the strains show best growth in tenai leaf decoction and the poorest growth in Brown's solution.

(2) *Various sources of nitrogen.*—The comparative development of the four fungi in media containing different substances as sources of nitrogen, viz., potassium nitrite, potassium nitrate, asparagin, ammonium sulphate, peptone and urea was studied.

TABLE III.—*The following table gives the average daily growth in diameter of the colonies of the strains in millimetres.*

Source of nitrogen.	Paddy Piricularia.	Ragi Piricularia.	Tenai Piricularia.	Digitaria Piricularia.
	M.M.	M.M.	M.M.	M.M.
Ammonium sulphate	1·32	1·41	1·39	..
Potassium nitrite	..	..	..	..
Potassium nitrate	0·77	1·07	1·30	0·93
Urea	1·61	1·32	1·95	1·37
Asparagin	2·94	3·04	2·30	1·47
Peptone	3·64	3·86	3·95	3·71

Peptone appears to be the best source of nitrogen and asparagin as the second best source. Urea, ammonium sulphate and potassium nitrate come next in the order of preference.

(3) *Various sources of carbon.*—The fungi were grown in media containing glucose, sucrose, maltose, soluble starch, lactose and cellulose, and their growth measured. Paddy, ragi and tenai *Piricularia* did not show preference to any one source of carbon. Digitaria *Piricularia* showed decidedly better growth in glucose and maltose than in starch and lactose.

(4) *Growth in media having different PH. values.*—The best growth was found to obtain in media with *PH.* value of 5 to 7 for all the isolates.

(5) *Optimum temperature of growth.*—The optimum temperature for growth would appear to lie somewhere between 25° and 30°C. There is no growth in temperatures below 5° C and above 36° C.

(6) The progressive shifts of pH of the medium in which the different isolates were grown, and the corresponding dry weight of the fungus material developed at weekly intervals were determined for four weeks. There is a steady increase in the dry weight of material for every week of growth. The pH value shifts from 5 to 6 at the end of first week and then shifts back to 5 and was found to remain more or less steady at that level even at the end of the fourth week.

(7) *Enzymes produced by the four strains of Piricularia.*—The production of trypsin, erepsin, diastase, amidase, inulase and lipase was tested as per technique adopted by Uppal and Kulkarni. ("Physiology and Biology of *Fusarium vasinfectum* *Indian Journal of Agricultural Science*—7, pages 413 to 441, 1937) and the production of maltase, sucrase, urease and lactase were tested by the methods followed by Ganen (K.H.) in his studies on *Polyporus abietinus.* Phytopathology 8, pages 839 to 845.

TABLE IV.—*Table showing the strains and the enzymes prodcued by them.*

Strains. / Enzymes.	Paddy *Piricularia.*	Ragi *Piricularia.*	Tenai *Piricularia.*	Digitaria *Piricularia.*
Trypsin	+	+	+	+
Erepsin	—	+	+	—
Diastase	+	+	+	+
Amidase	+	+	+	+
Inulase	+	+	+	+
Lipase	+	+	+	+
Maltase	+	+	+	+
Sucrase	+	+	+	+
Urease	—	—	—	—
Lactase	+	+	+	+

N.B.—Positive signs show the production of the enzyme and negative signs their non-production.

Trypsin, diastase, amidase, inulase, lipase, maltase, sucrase and lactase are produced by all the strains. Urease is produced by none. Erepsin is produced by Ragi and tenai *Piricularia* and not by paddy and Digitaria *Piricularia.*

(8) *Viability of the fungus.*—Neck (of the panicle) and nodes of paddy (Adt. 10) affected by the disease were collected in March 1942 and were preserved in the laboratory as follows :—

(1) in a dry state in flasks and kept at laboratory temperature 28 to 32°C,

(2) buried in paddy soil in flasks and kept at laboratory temperature and

(3) in a dry state in flasks and kept at 20°C in a constant temperature cabinet.

The viability of the fungus in the materials was tested by transferring them to agar plates, on the fifteenth of every month. The fungus remained viable till the February of the following year.

(9) *Cross inoculation experiments.*—Cross inoculation experiments were carried out with the four strains of *Piricularia* on the following cereals and grasses: Oats, wheat, ragi, *Eleusine indica*, tenai, *Setaria verticillata* and *Setaria glauca*. The four strains were cultured on sterile leaf bits of their respective hosts in potato tubes for profuse sporulation and spore suspension of each was sprayed on the plant kept in a glass cage.

TABLE V.—*Table showing results of cross inoculation experiments.*

Hosts.	Paddy *Piricularia.*	Ragi *Piricularia.*	Tenai *Piricularia.*	Digitaria *Piricularia.*
Oats	—	—	—	—
Wheat	+	+	—	+
Ragi	—	+	+	—
E. indica	—	+	+	—
Tenai	—	+	+	—
S. verticillata	—	—	+	—
S. glauca	—	+	+	—

4. *Paddy foot-rot*—Fusarium moniliforme—*Fungicidal trials.*—An experiment was laid out to test the efficacy of three seed dressing fungicides in the control of paddy foot-rot. The fungicides were—(1) Compound (II received from Prof. Seshadri of Andhra University), (2) a non-poisonous proprietary preparation N.G. 3399/9 N (received from Imperial Chemical Industries), (3) Formalin charcoal dust.

For comparison Bayer's 'Ceresan' (Tillantin R) was used as the standard fungicide. The arrangement of the plots was of the 'Latin square' plan with five replications. The strain of paddy used for trial was 'Gobikar' a strain highly susceptible to foot-rot. The seeds were first treated with spore suspensions of the causal organism air dried and then treated with the respective fungicides and sown in replicated plots. Observations on the incidence of the disease were recorded twice a week for a period of one month.

TABLE VI.—*Paddy foot-rot—Percentage of infection.*

Treatment.	Strength. GRAMS PER LB.	Percentage incidence of disease.
A. Formalin dust	1·5	2·82
B. Ceresan	1	1·32
C. Compound II.	1	1·28
D. N.G. 3399/9 N	1	8·50
E. Control	..	37·72

The results were highly significant. Control showed maximum infection. The order of efficacy of treatments at 5 per cent level was as follows :—

Critical difference at 5 per cent level 6·18

Conclusion :—C. B, A, D, E.

Ceresan and Prof. Seshadri's compound are distinctly superior to N.G. 3399/9 N.

Formalin dust is not superior to N.G. 3399/9 N though not significantly inferior to ceresan and compound II. Control showed the heaviest infection.

5. Helminthoporioise *of cereals*—(1) *Paddy*—Helminthosporium oryzae—*The seat of infection in* Helminthosporium *diseased paddy grains.*—With a view to finding out in what part of the grain the fungus perennates, seeds suspected to harbour the fungus, were selected, and the glumes, germs and endosperm of each grain were separated, and transferred to agar plates, and the development of the fungus noted. The experiment showed that the fungus is present in the glumes, germs and endosperms of the grains and hot water treatment (steeping in hot water at 55° C for 10 minutes) is effective in controlling infection from all these sources.

(2) *Physiological studies.*—(*a*) *Shift of pH in nutrient media induced by the fungus.*—The fungus was grown in Waksman's solution, adjusted to different *pH* values, ranging from 4·05—8·72.

TABLE VII —*Table showingthe pH values recorded every week during the growth.*

Initial pH.	First week.	Second week.	Third week.	Fourth week.	Fifth week.
1 4·05	4·05	3·81	3·73	3·73	3·73
2 4·83	4·80	4·23	4·32	4·83	6·52
3 5·67	4·83	4·91	7·11	7·61	7·95
4 6·69	6·01	6·26	7·45	7·95	8·04
5 7·03	6·52	6·69	7·53	8·04	8·04
6 7·45	6·69	7·11	7·70	8·31	8·31
7 7·78	7·11	7·11	7·70	8·31	8·31
8 8·72	7·11	7·11	7·70	8·31	8·31

There is a fall in the pH during the first week and a rise afterwards, in all the series except the series in which the initial value was 4·05. One peculiar feature of this fungus is that it grows over a wide range of pH.

(*b*) *Growth of the fungus in relation to different sources of carbon.*—The fungus was grown in media (solid and liquid) containing the following substances as sources of carbon : glucose, sucrose, maltose, soluble starch, lactose and cellulose, and the development of the fungus was measured by the linear growth of the fungus and the weight of the mycelial mat, respectively. The results obtained in the solid media series did not give a true indication of the development of the fungus in the different

media. In the liquid media series the order of preference was as follows : glucose, maltose, sucrose, soluble s arch and lactose.

Effect of fungicides.—Silver nitrate, Agrosan G, mercuric chloride and ceresan wet were effective at a strength of 0·025 per cent solution in water in killing the spores of *H. oryzae.* In another experiment the effectiveness of N.G. 3399/9 N, Agrosan G, and ceresan was tested. While all the three were found equally effective in killing spores adhering to the outside of the glumes, Ceresan and Agrosan G, also effectively inhibited fungus development from within.

Varietal resistance trials.—Sixteen Mtu. cultures were tested for their relative susceptibility to *Helminthosporium* disease, and the following three varieties as judged by the intensity of leaf infection showed least susceptibility : Mtu. 10, Mtu. 4 and Mtu. 2, and the following showed highest incidence : Mtu. 14, Mtu. 16 and Mtu. 3. As the weather conditions were not favourable for high infection, the yield of any of the varieties tested was not affected to any appreciable extent.

6. *Ragi blast.*—Piricularia sp. –(*a*) *Varietal resistance in relation to time of sowing.*—The experiment was repeated at Coimbatore during the year with the same eighteen varieties tested last year. Their duration ranged from 105 to 135 days, and the sowing was so timed to have the transplanting done in July, August and September. Observations on the incidence of the disease were recorded. The results are tabulated below :—

TABLE VIII.—*Table showing relative degrees of earhead infection.*

Serial number and variety.	Duration (in days).	Average percentage of infection in the crop.		
		July (harvested in October).	August (harvested in November).	September (harvested in December).
1 E.C. 1507	105	Nil	9·6	10·1
2 E.C. 3845	107	..	8·4	10·5
3 E.C. 1000	110	..	7·4	7·6
4 E.C. 3868	110	..	7·3	9·5
5 Palur	110	..	6·2	15·2
6 E.C. 3854	111	..	21·0	9·4
7 E.C. 3842	115	..	10·1	12·2
8 Erode	117	..	5·6	7·1
9 Coimbatore	117	..	7·2	17·3
10 Hindupur	118	..	12·2	5·5
11 E C. 4191	118	..	6·6	12·9
12 E.C. 155	120	..	..	4·6
13 E.C. 593	120	..	9·7	20·1
14 E.C. 4015	121	..	11·8	20·0
15 R.42	121	..	13·8	34·4
16 E.C. 1540	125	..	2·3	8·4
17 E.C. 24	135	..	5·8	10·5
18 H. 22	135	..	8·1	19·1

(1) The July transplanted crop escaped infection.

(2) In the August planted crop the incidence ranged from 0 to 21 per cent. E.C. 155 showing the lowest incidence.

(3) In September planted crop the incidence was heaviest. E.C. 155 again showing least incidence. R. 42 showed highest incidence.

(*b*) *Fungicidal treatments against ragi blast.*—A field experiment to test the efficacy of the following treatments was laid out :—

(1) Bordeaux mixture, 1 per cent (sprayed on the plants at the time of earhead emergence).

(2) Bordeaux mixture ½ per cent (sprayed on the plants at the time of earhead emergence).

(3) Bordeaux mixture 1 per cent (sprayed when the earheads are in the milk stage).

(4) Bordeaux mixture ½ per cent (sprayed when the earheads are in the milk stage).

(5) Sulphur dusting on the plants at the earhead emergence stage.

(6) Sulphur dusting on the plants at the milk stage.

(7) Control—No treatment.

Lay out—Randomized block.
Replications—Six.
Date of transplanting—11th August 1943.
Date of harvest—12th November 1943.

TABLE IX.—*Table showing fungicidal treatments for controlling earhead infection and the results.*

Serial number and treatment.	Rate per acre.	Mean percentage of infection.
1 Bordeaux mixture 1 per cent emergence stage.	225 gallons.	2·2
2 Bordeaux mixture ½ per cent emergence stage.	225 ,,	2·7
3 Bordeaux mixture 1 per cent at milk stage.	225 ,,	1·9
4 Bordeaux mixture ½ per cent at milk stage.	225 ,,	1 8
5 Sulphur dusting at emergence stage.	56 lb.	2·3
6 Sulphur dusting (milk stage.)	56 lb.	2·8
7 Control—No treatment ..	..	10·0

The results are significant at 5 per cent level.

Conclusions.—All the treatments are effective in checking incidence, and there is no significant difference between one treatment and another. There was no significant correlation between the degree of infection and the yield by weight or volume of grain.

(c) *Pathogenicity tests* —Two varieties of ragi from Chittoor, viz., *Thella Surattai* and *Thunna pothu* reported to be resistant to *Piricularia* were tested for their susceptibility under pot culture conditions, by inoculating pure cultures of the fungus on mature plants at the earhead stage and seedlings. It was found that both the varieties took infection and their resistence being probably only a case of escape.

(d) *Humidity and spore germination.*—In an experiment to find out the range of relative humidity at which spores of ragi *Piricularia* germinate, it was found that good germination was effected only at relative humidities higher than 92.

7. *Tenai blast*—Piricularia setariae—*Varietal resistance trials.*—Fourteen varieties of tenai kindly supplied by the Millet Specialist were tested for their varietal resistance to *Piricularia* under field conditions. The incidence of leaf infection was recorded from time to time and the percentage of infection was found to range from 17·7 to 69·5 in the different varieties, but the results were not statistically significant, and the variety 1383 which showed only 0·4 per cent infection last year showed 50 per cent infection this year.

8. *Ginger soft-rot*—Pythium sp.—The storage and field experiments started during the previous year were repeated.

(a) *Storage experiments.*—Seed treated with various fungicides were stored in pits for six months and were examined after that period and the quantity of good and healthy seed obtained was taken as an index of the efficacy of the treatment. The following table gives the results : —

TABLE X.

Serial number and treatment.	Quantity pitted.	Healthy seeds obtained.	Diseased seed recovered.
	LB.	LB.	LB.
1 Mercuric chloride (0·1 per cent for 1½ hours)	50	36¼	1¼
2 Agrosan G. (0·25 per cent for ½ hour)	50	40½	1
3 Ceresan (dry) (0·25 per cent for ½ hour)	50	37½	2¼
4 N. G 3399/9 N. (0·25 per cent for ½ hour)	50	37	2¼
5 Ceresan (wet) (0·1 per cent for ½ hour)	50	34	4
6 Bouisol (0·35 per cent for ½ hour)	50	29½	6
7 Control	50	32	3

It was found that seeds treated with N.G. 3399/9 N, ceresan (wet) and also the seeds in control series were badly infested with scale insects, and the quantity of seed had considerably deteriorated.

(*b*) *Field experiments.*—The field experiment was laid out on the same lines as in the previous year (split plot randomised).

The treatments were as follows :—

Main treatments.—(*a*) Application of bordeaux mixture to soil at the rate of 3 gallons for 30 square feet. (*b*) No treatment.

Sub-plot treatments.—(1) Steeping the seed in 0·1 per cent mercuric chloride solution for 1½ hours before storage, (2) steeping the seed in 0·1 per cent mercuric chloride for 1½ hours before planting, (3) steeping the seed in 0·1 per cent mercuric chloride before storage and before planting, (4) steeping the seed in 0·25 per cent solution of Agrosan G. for ½ hour before storage, (5) steeping the seed in 0·25 per cent solution of Agrosan G. for ½ hour before planting, (6) steeping the seed in 0·25 per cent solution of Agrosan G. for ½ hour before storage and before planting, (7) treating with Ceresan (dry) 0·25 per cent before storage, (8) treating with Ceresan (dry) 0·25 per cent before planting, (9) treating with Ceresan 0·25 per cent before storage and before planting, (10) Ceresan (wet) 0·1 per cent solution for ½ hour before planting, (11) Ceresan (wet) 0 2 per cent solution for ½ hour before planting, (12) N.G. 3399/9 N.O. 25 per cent solution for ½ hour before planting, (13) open fire sterilization of the beds before planting, (14) application of ½ per cent copper sulphate solution to the soil, (15) control—no treatment.

The experiment was laid out in three localities—Perintalmanna, Manjeri and Taliparamba—but as the produce of the experimental plots were tampered with at Perintalmanna the results represent the mean values of the data obtained in two places only.

TABLE XI.—*Table showing treatment-war yields for* 1942–43.

Serial number of treatments.	Total yield for 4 repetitions.	Average.
	oz.	oz.
1 M. Chloride before pitting	241	60·3
2 Do. planting	196	49·0
3 Do. pitting and planting ..	150	37·5
4 Agrosan G. before pitting	262	65·5
5 Do. planting	307	76·8
6 Do. pitting and planting ..	246	61·5
7 Ceresan (dry) before pitting	329	82·3
8 Do. planting	263	65·8
9 Do. pitting and planting ..	324	81·0
10 ,, (wet) 0·1 per cent before planting..	262	65·5
11 N. G. 3399/9 N ,, ..	242	60·5
12 Open fire ,, ..	281	70·3
13 Copper sulphate ½ per cent solution to soil	266	66·5
14 Ceresan (wet) 0·2 per cent before planting.	297	74 3
15 Control—no treatment	280	70·0

C. D. 26·7 significant at 5 per cent level.

7, 9, 5, 14, 12, 15, 13, 10, 8, 4, 6, 11, 1, 2, 3

(1) The superiority of Ceresan (dry) over other treatments was again established. (2) Treatment before pitting is superior to treatment at planting time. (3) Mercuric chloride and Agrosan G.

appear to exert a depressing effect on the yield when the seed rhizomes are steeped twice (i.e.) before planting and before storage in them.

In the main treatments application of bordeaux mixture to the soil did not control the disease or affect the yield to any extent.

9. *Redgram wilt—Fusarium udum var. Cajani—Varietal resistance trials.*—The varietal resistance trials were continued during the year in collaboration with the Cotton Specialist in Field No. 7 of the Cotton Breeding Station at Coimbatore. Wilt counts were taken at weekly intervals after the appearance of the disease and the results were statistically analysed. Hundred and thirty-two cultures were included in the trial.

The following cultures showed high degree of resistance :—

TABLE XII.—*Table showing list of cultures of redgram showing resistance to wilt.*

	Serial number and name of culture.	Group number.	Percentage of infection.
1	P.80-2 X B.W.,5-1/1	I	2·5
2	P.80-2 X 2058/2-1 2/4	III	8·3
3	P.80-3 X 2013/1-1/18	IV	4·3
4	Do. 1/19	IV	4·5
5	Do. 2/22	IV	9·0
6	B.W.5 X P.80-2-1/8	VII	8·0
7	Do. 1/18	VII	10·3
8	B.W.5 X P.80-2 1/11	VII	5·3
9	P.80-2 X B.W.5 1/7	VIII	10·3
10	P.80 3 X 2013-1 1/2	VIII	1·5
11	P.80-3 X 2013-1 2/3	IX	1·3
12	Do. 2/4	IX	6·3
13	Do. 2/8	IX	5·0
14	Do. 2/19	IX	2·5
15	Do. 2/20	IX	Nil
16	Do. 2/23	IX	6·3
17	P.80-5-1	XIII	4·0
18	Do. -2	XIII	2·5
19	P.80-6-1	XIII	5·0
20	Do. -3	XIII	1·3
21	B.W.I-1	XIV	1·5
22	Do. -4	XIV	3·5
23	2058/2-I 1	XIV	5·3
24	2829-III-1	XIV	9·3
25	800/2	XIV	4·0

The maximum infection noted in the above cultures was 10 per cent and in some nil incidence was recorded. The remaining cultures tested showed susceptibility ranging from 10 to 100 per cent.

10. *Bengalgram wilt—Fusarium orthoceras var. Ciceri.*—With a view to confirm the beneficial effect recorded previously of seed treatment with (*a*) Bengalgram root nodule organism and Ceresan, further experiments were laid out with the following treatments : (1) Bengalgram root nodules, (2) Agrosan G., (3) Ceresan, (4) N. G. 3399/9 N and (5) control.

The results of the experiment were not significant.

11. *Sorghum smut—Sphacelotheca sorghi.*—Owing to the non-availability of sulphur and the paucity of copper sulphate it was thought desirable to find out suitable, locally available substitutes or alternative methods of control. For this purpose an experiment was laid out to test the comparative efficacy of the following treatments : (1) steeping the seed in cows' urine before sowing (a method in vogue in some rural areas), (2) steeping the seed in water for four hours and then drying it before sowing (a method reported to be of some success in Burma), (3) steeping the seed in a mixture of cows' urine and powdered asafœtida and *Acorus calamus*, (4) treating the seed with 1 per cent solution of copper sulphate for 30 minutes, (5) treating the seed with sulphur, (6) control—no treatment.

Cholam seed was mixed with large quantity of viable smut spores, and then subjected to the treatments enumerated above. The treated seeds were sown in replicated plots in randomized blocks and the incidence of disease at the earhead stage was recorded. Unfortunately, owing presumably to the soil temparature conditions obtaining at the time of sowing being unfavourable for the germination of smut spores, the experiment did not give any tangible results. No smutted ears were seen even in the untreated control plots. The experiment has to be repeated under more favourable conditions.

12. *Tobacco—Pythium sp. 'Damping off' of seedlings—Control methods.*—Field and pot culture experiments were laid out at Coimbatore to assess the comparative efficacy of (1) Bordeaux, mixture, (2) Bouisol, (3) colloidal copper, (4) cultural methods—such as raising the level of seed beds and sterlizing the surface soil by the application of heat.

Field experiments.—

Layout : split plot, randomized.

Treatments.

Main .. .. { Raised beds .. { Sterilized. / Unsterilized. } *vs.* Low beds .. { Sterilized. / Unsterilized. }

Replications—5.

Area of sub-plot—4′ × 2′.

Sub-plots.—(1) Bouisol applied to the seedlings once in a fortnight at a strength of (*a*) 1 oz. in 2 gallons of water ; (*b*) 1 oz. in one gallon of water; (2) Bordeaux mixture 1 per cent ; (3) Home-made colloidal copper solution 1 in 30.

The above solutions were applied to the seed beds with a rose can at the rate of 1 gallon per 2 square yards of bed thrice during the course of the experiment.

Counts of the total number of seedlings per plot were taken one month after sowing and the results analysed. The results were not statistically significant as the number of deaths due to damping off was low owing to dry weather conditions; but raised beds gave a better stand than low beds and sterilized beds were better than unsterilized beds.

TABLE XIII.—*Table showing the number of seedlings per treatment (sub-plots).*

Treatments.	Raised.		Low.		Total.
	Sterilized.	Unsterilized.	Sterilized.	Unsterilized.	
Bouisol (1 oz. in 1 gallon) ..	1,312	1,136	1,879	1,399	5,717
Bouisol (1 oz. in 2 gallons)..	1,530	1,000	1,267	883	4,685
Colloidal copper (1 in 30) ..	1,986	1,656	1,784	1,622	7,048
Bordeaux mixture 1 per cent.	1,788	1,105	1,371	1,814	6,078
Control	2,193	1,888	1,793	1,657	7,531
Total ..	8,809	7,785	8,094	7,364	

TABLE XIV.—*Table showing number of seedlings per treatment (Main treatments).*

	Sterilized.	Unsterilized.	Total.
Raised	8,809	7,785	16,594
Low	8,094	7,366	15,460
Total ..	16,903	15,151	

Pot experiments—Experiment I.—Seedlings were raised in seedling pans and the following treatments were applied once a week till the seedlings were ready for transplanting: (1) Home-made colloidal copper solution 1 in 30; (2) Bordeaux mixture 1 per cent; (3) Bouisol 1 oz. in 2½ gallons; (4) control. Each treatment was replicated five times.

Results.—Mean number of seedling per pot (in tons).

(1) Home-made colloidal copper .. 32·8
(2) Bordeaux mixture 1 per cent .. 21·8
(3) Bouisol (1 oz. in 2½ gallons) .. 29·0
(4) Control .. .. 10·0

Results : significant at 5 per cent level (C.D. 11·8)

1, 3, 2, 4

Conclusions.—Damping off is effectively controlled by the treatments. Bordeaux mixture is inferior to colloidal copper.

Experiment II.—Treatment : (1) Bouisol (1 oz. in $2\frac{1}{2}$ gallons), (2) No treatment.

Replications—10.

Spraying once in three days after second fortnight.

Number of sprayings given—9.

Special damping off conditions were created by excessive watering.

Results.—Meaning number of seedlings per pot.

Bouisol .. 225·3
Control .. 62·5

Results : Significant at 5 per cent level.

13. *Citrus mottle leaf—Deficiency disease.*—Experiments for the control of the disease are in progress in three places in the presidency; namely, Kodur, Tanjore and Yercaud :—

Kodur.—The experiment was begun last year and the following statement on page 60 represents the observations carried out during the year regarding the progress of the disease under different treatments. Zinc sulphate applied on the foliage exerts a marked beneficial effect on the trees, and combination mixture (which includes zinc sulphate) is second best in the series. No evidence was obtained regarding the beneficial effect of any of the soil treatments.

Tanjore.—An experiment was laid out on the same lines as at Panyam and Kodur and periodic observations were recorded. The results obtained are in conformity with those obtained at Kodur and Panyam, namely, that the mottling disease of citrus can be cured by the application of zinc sulphate as a spray.

Yercaud.—This tract represents a departure from the other three tracts in that the variety of orange is the loose jacket (*C. reticulata*) and the crop is raised under rain-fed conditions at an altitude of about 4,000 feet. The experiment was on the same lines as in the other places but two more treatments were included, viz., application of lime to soil, (*a*) lime obtained locally and (*b*) lime obtained from outside. The object of including the lime treatments was to find out if the lime obtained locally exerts a beneficial effect on the citrus trees on account of traces of magnesium contained in it. The results of the observations so far carried out indicate that here again zinc deficiency is the factor that is chiefly responsible for the mottle leaf disease of citrus and here as elsewhere the disease could be controlled by the application of zinc sulphate as a spray. Final observations are however yet to be made.

14. *Mushroom culture.*—The cultivation of edible mushroom was continued on a limited scale, and the following observations were made The mushroom *Volvaria diplasia* can be successfully cultivated in Coimbatore in the summer months only. In the cold season from September to March the fungus does not grow in straw beds and hence no mushroom production is possible.

TABLE XV.—*Table showing the results of periodical observations taken in 'Citrus mottle leaf' experimental garden, Kodur.*

Serial number and treatments.	Preliminary observations, March 1942.			First observation, June 1942.			Second observation, August 1942.			Third observation, November 1942.			Fourth observation, May 1943.		
	Category values.	Percentage mottle-leaf.	Internodal lengths.	Category values.	Percentage mottle-leaf.	Internodal lengths.	Category values.	Percentage mottle-leaf.	Internodal lengths.	Category values.	Percentage mottle-leaf.	Internodal lengths.	Category values.	Percentage mottle-leaf.	Internodal lengths.
Sprays—															
1 Combination mixture ..	1·0	48·2	1·3	2·8	26·4	1·9	2·8	Leaf counts not taken.	1·6	2·0	19·7	1·6	1·6	18·2	1·7
2 Zinc sulphate lime mixture.	0·4	56·4	1·6	3·6	26·3	1·9	4·0		1·7	4·0	3·3	1·8	4·0	3·2	1·8
3 Magnesium sulphate lime mixture.	0·4	63·0	1·4	1·0	44·3	1·9	0·8		1·5	0·4	32·9	1·6	0·6	58·5	1·6
4 Iron sulphate lime mixture.	0·6	74·9	1·4	0·8	61·7	1·7	0·6		1·7	0·6	26·9	1·5	0·6	42·1	1·9
5 Manganese sulphate lime mixture.	0·2	45·3	1·5	1·0	35·8	1·8	1·0		1·4	1·0	28·8	1·6	0·6	47·3	1·6
6 Copper sulphate lime mixture.	0·8	56·0	1·5	1·2	42·7	2·0	1·4		1·6	1·4	23·8	1·6	0·8	55·4	1·9
Soil application—															
1 Zinc sulphate	0·6	68·8	1·5	2·2	53·7	1·9	1·8		1·6	1·8	30·3	1·6	1·8	30·2	1·8
2 Magnesium sulphate ..	0·4	53·4	1·5	1·4	29·7	1·9	1·2		1·7	1·2	22·7	1·6	1·4	25·8	1·6
3 Iron sulphate	0·4	53·2	1·4	0·8	38·8	1·8	1·0		1·5	1·0	30·1	1·5	1·0	27·4	1·7
Control	0·6	66·2	1·5	0·8	43·0	1·8	1·0		1·6	1·0	33·8	1·6	0·8	42·0	1·7

II. Virus Diseases Investigation.

Sugarcane mosaic—Varietal resistance.—The annual field trials to estimate the relative resistance of sugarcane varieties to the mosaic disease were continued. Eleven varieties were included for trial for 1942–43. The results are furnished below.

Table XVI.—*Varietal resistance test to Sugarcane mosaic.*

Serial number and name of variety. (1)	Percentage infection. (2)	Serial number and name of variety. (1)	Percentage infection. (2)
1 Co. 422	..	7 Co. 443	..
2 Co. 419	35·0	8 Co. 434	..
3 Co. 411	..	9 Co. 527	11·7
4 Co. 213	65·1	10 Co. 520	19·9
5 Uba. S.H. ..	..	11 Co. 523	26·9
6 Co. 455	4·9		

2. *Cotton—Stenosis—Transmission studies.*—The disease was successfully transmitted from diseased to healthy plants by grafting. The experiments were repeated both at Adoni and Coimbatore on the same lines as reported in the previous year and the results are in conformity with those obtained previously, namely, that the disease is transmissible.

Insect vectors.—All attempts to find out the insect vectors responsible for the transmission of the disease in the field have so far been unsuccessful. During the year transmission experiments under controlled conditions were carried out to see if the following insects found on cotton at Adoni were capable of transmitting the disease. *Euitetix phycitis* (Jassid), *Empoasca sp.* (Jassid), *Bemesia gossypiperida* (Aleurodid), and an unidentified capsid. No case of successful transmission was obtained.

Disease survey.—A survey was made of the cotton area in the Bellary district, where the incidence of the disease has been reported to be usually such as to cause severe loss to the crop. It was found that during the year the highest incidence noticed in any place did not exceed 4 per cent of the crop and that 3·5 was about the average incidence in the tract during this season. The disease was widespread and was noticed in every field examined. The Mungari crop alone suffers, though the Hingari types H. 1, for example, take the disease if grown as an early crop as at the Agricultural Research Station, Siruguppa. All the indigenous cottons are susceptible.

3. *Tobacco mosaic.*—A strain of mosaic isolated from diseased tobacco plants collected at Adoni was found to be identical with Johnson's tobacco virus I producing typical local lesions on *Nicotiana glutinosa.*

4. *Gingelly proliferation.*—Three cases of successful transmission of the disease with the aid of the insect *Euttetix phycitis* were obtained. Further evidence is necessary before definite conclusions can be drawn, though the present indications are, that this disease is of virus origin and that it is transmissible by an insect.

III. Work on Phanerogamic Parasites.

Field and pot culture experiments for the control of Orobanche cernua var Desertorum.—At the instance of the Imperial Council of Agricultural Reserach, experiments were laid out at Guntur and Coimbatore with the kind co-operation of the District Agricultural Officer, Guntur, and Superintendent, Central Farm, respectively, to find out if the application of sunflower material—roots, stems and leaves to the soil reduces the incidence of *Orabanche cernua* on tobacco when a crop of tabacco is raised subsequent to the application. The experiment was based on the reports of the experimental station at Rosto von Don in Russia regarding successful control of the parasite being effected by the treatment with sunflower which stimulates the Orobanch seeds to germinate in the soil even without the presence of the host plant, which results in their subsequently perishing for want of a host plant to feed upon. The objects in carrying out the experiment in South India were : (1) to find out if control is effected by this method, (2) to guage the time that should elapse before the matter gets incorporated in the soil, and thus aid in destroying the seed of Orobanche, (3) the optimum quantity of the material that should be added, (4) whether organic matter other han sunflower exerts a similar influence and (5) whether the method is practicable under South Indian conditions.

The scheme of the experiments was as follows : (1) Pot experiments. (2) Field experiments.

Pot experiments.—Treatments :—

(*a*) Sunflower material at three levels of application: (1) 30 grams, (2) 45 grams, (3) 60 grams per kilo of soil.

(*b*) Organic matter other than sunflower (sunnhemp) at three levels (pillipesara at Guntur) : (1) 30 grams, (2) 45 grams, (3) 60 grams per kilo of soil

(*c*) Control.

Total of seven variants and each variant in seven plots.

Tobacco was transplanted in five fortnightly intervals in each series.

Materials and methods.—Glazed porcelain pots (6″ × 4″) were filled with weighed quantity of pot soil up to ½ inch from the rim, and equal quantities of Orobanche seed was thoroughly mixed with the top soil to a depth of nearly two inches. Sunflower and sunnhemp material cut, dried and ground into a state of powder was

applied at the rates specified and thoroughly mixed with the soil. The pots were watered and kept moist Tobacco seedlings were raised in seedling pans and planted in fortnightly intervals. Casualties were replaced with fresh transplants The incidence of Orobanche was recorded in each pot as soon as emergence was noticed and the shoots of the parasite pulled out.

The pot experiments gave significant results at Coimbatore. Sixty grams of sunflower and sixty grams of organic matter showed less incidence when the experimental series were taken into consideration in the aggregate. But when the fortnightly series were considered separately significant results were obtained only in the fourth fortnightly series in which the control showed significantly high emergence.

In Guntur in the third and fortnightly series significant results were obtained. But curiously the organic matter and sunflower series showed higher emergence than control possibly due to the stimulating influence of the former.

The experiments have to be repeated for conclusive results.

Field experiments.—The experiments were repeated in two places Guntur and Coimbatore.

Layout —Randomized block, Replication : 6

Treatments :—

(*a*) Sunflower grown *in situ* cut and incorporated in the plot.

(*b*) Sunflower grown in another field cut and applied at the rate of 35 tons per acre.

(*c*) An equivalent quantity of organic matter (*Phaseolus trilobus*) in Guntur and *Gliricidia* in Coimbatore cut and applied to the soil.

(*d*) No treatment.

At Guntur owing to unfavourable conditions of rainfall and consequent failure of the crop, the experiment failed to give any results. At Coimbatore the experiment was carried out in field No. 48 in the Central Farm. Tobacco was raised in the nursery and when seedlings were ready were transplanted. Two weeks after, the organic matter and sunflower material were applied to the soil. The incidence of Orobanche was recorded from time to time. The results were not significant.

Effect of previous crop grown during the same gear.—An experiment was laid out in F No. 29 in the Agricultural Research Station, Guntur, to find out the effect of growing various crops in the field on the incidence of Orobanche in tobacco when the crop is grown later in the same field during the year.

The following constituted the treatments :—

(1) Raising a crop *Setaria italica*, (2) raising a crop of *Arachis hypogea*, (3) raising a crop of *Andropogon sorghum*, (4) raising a crop of *Zea mays*, (5) raising a crop of *Pennisetum typhoides*, (6) fallow (control).

The plots were sown to the different crops in the first week of June and the experiment is in progress.

Effect of previous crop grown in different years on the incidence of Orobanche cernua on tobacco.—To find out if longer intervals between one crop of tobacco and another and growing of other crops in the interval will effect a reduction in the incidence of Orobanche on tobacco, the following experiment was laid out at Guntur. The experiment is in progress:—

Lay out Scheme.	Randomized Block.	Replicatons 6.	Treatments 6.
I. Tobacco	Tobacco	Tobacco	Tobacco
II. Pyru Jonna ..	Do.	Pyru Jonna	Do.
III. Tobacco	Chillies	Coriander	Do.
IV. Do.	Tobacco	Variga	Do.
V. Groundnut.. ..	Do.	Maize	Do.
VI. Chillies	Do.	Sajja	Do.

The above represents the cropping practice obtained in the locality.

Abnormal drooping in tobacco plants.—Consequent on infestation with Orobanche, tobacco plants loose their turgidity and the leaves become flaccid and droop as if for want of water but the drooping caused by Orobanche infestation can always be distinguished by the failure of the plants to recover to normality even during the nights, whereas plants drooping on account of drought during the day recover during the nights. This drooping symptom is noticeable long before the emergence of Orobanche above ground.

Severe infestation of Orobanche in ratoon crops of natu tobacco in the Lankas of the Godavari Delta.—The practice of raising ratoon crops of *natu* tobacco is prevalent in lankas of Godavari delta. A second ratoon is usually taken 2 to 2½ months after the first harvest. A survey in these tracts indicated that the incidence of Orobanche in the ratoon crop is very heavy and the land becomes foul with the parasite smothering the crop. It is desirable that steps are taken to discourage this uneconomic practise.

Incidence of broom rape in the pati soils of Guntur and Krishna districts.—There is a popular belief among ryots that the *pati* soils are free from infestation of broom rape. A survey of a number of holdings in Chebrole village of Tenali taluk and Mustabada village in Gannavaram taluk of Krishna district where the soil is typically of the *pati* kind proved the belief to be unfounded.

Striga lutea on sorghum.—The incidence of this parasite was higher during the year in all the fields sown to periamanjal cholam in the Central Farm drylands. The control of striga offers considerable difficulty since the seed may lie dormant in the soil for many years and infest successive crops. One method of control favoured in other countries is the raising of a graminaceous trap crop and ploughing it in as soon as the emergence of the parasite is noticed well above ground. This method however is difficult to adopt in South India owing to the impossibility of raising a trap crop in the dry lands in the season sufficiently early, to allow time

for the main crop to be sown. Recent work in South Africa has shown that besides graminaceous hosts other crops plants such as groundnut and sunhemp for example, are capable of inducing striga germination, without themselves however acting as hosts and a method is suggested in which control of the parasite is effected in a shorter time than is needed to grow trap crops and plough them in.

Ryots in Coimbatore believe that striga can be kept under check by ploughing the land only when the soil is moist after a rain, and never in a dry condition.

In order to test the efficiency of these possible methods of control two experiments were laid out in the Central Farm. F. No. 56 in randomized blocks replicated.

Experiment (1) consisted of the following treatments: (*a*) growing maize and the striga plants pulled out on emergence, (*b*) growing maize and ploughing it in after striga emergence, (*c*) growing sorghum and the striga plants pulled out on emergence, (*d*) growing cholam and ploughing it as in (*b*) and (*e*) growing groundnut and ploughing it in.

A subsequent crop of periamanjal cholam raised in the plots and the incidence of striga in the different plots will indicate the relative efficacy of the treatments.

Experiment (2) consisted of two treatments only. Ploughing the land which was kept fallow (1) in dry condition and (2) when the soil was wet after the rains.

The experiments are in progress.

IV. Quarantine Service and Legislative Measures.

The Madras Agricultural Pest and Diseases Act was in force in respect of the following plant diseases:—

(1) *Bud-rot of palmyra and coconut palms in West Godavari, East Godavari, Krishna and parts of Guntur and Malabar districts—West Godavari.*—The Special staff consisting of one Tahsildar, six Revenue Inspectors, nine maistris and eight peons were engaged throughout the year in enforcing the provisions of the act in the district. Ninety-eight thousand two hundred ninety-six trees were operated leaving a balance of 110,908 dead and diseased trees still to be dealt with.

East Godavari.—The special staff for this district consisted of eleven Revenue Inspectors, sixteen maistris and eleven peons. One thousand six hundred eighty-eight dead and diseased trees were operated during the year and a balance of 10,832 dead and diseased trees still remain to be dealt with.

Guntur.—One special Revenue Inspector, three maistris, one peon and four skilled labourers were in charge of the work.

Malabar (Palghat, Walluvanad and Ponnani taluks) — In addition to the special revenue staff of a special revenue inspector, his peon and three maistris, a sub-assistant in mycology helped by a messenger was in charge of the work. Nine thousand eight hundred and forty-two trees were detected and 8,501 were operated and 1,341 trees diseased and dead remain to be dealt with.

(2) *Mosaic disease of cardamoms.*—The Act continued to be in force during the year in the area notified, namely the Nelliampathies in the Palghat taluk of Malabar district for the specific purpose of preventing the entry of the mosaic disease of cardamems into this tract which is remarkably free.

(3) *Broom rape of tobacco* —The enforcement of the Act in the areas notified, viz., Guntur, East Godavari, West Godavari, Krishna and Nellore districts was in charge of a Special District Agricultural Officer and his staff consisting of 18 fieldmen and 54 maistris. The following table summarizes the activities of the special staff :—

		Nellore.	Guntur.	Krishna.	West Godavari.	East Godavari.
Staff engaged	Fieldmen ..	1	10	2	3	2
	Maistris ..	3	30	8	8	7
Number of pits dug ..		470	9,855	1,378	459	121
,, of heaps burnt ..		183	7,579	437	479	798
,, of notices issued ..		6	693	598	461	34

(4) *Wheat rust.*—At the instance of the Imperial Council of Agricultural Research the Act was brought into force during the year in the Nilgiri district and Kodaikanal taluk of Mathura district (1) to prohibit the cultivation of wheat and barley in the notified areas during the months of April to September, (2) to compel owners of lands to remove all stubbles, tillers and volunteer plants of wheat and barley from their lands during this period.

Two special demonstrators were appointed during the year in connexion with the working of Act in the Nilgiri district and the Agricultural Demonstrator, Kodaikanal, was in charge of the work in the Kodaikanal taluk.

(5) *Spike disease of sandal.*—The Act was in force in parts of Salem district in respect of the spike disease of sandal and the work of enforcing the provisions of the Act was in charge of the Madras Forest Department. The enforcement of the Act in fields belonging to the cultivators has now devolved on the Agricultural department.

(6) *Certificates.* Thirteen consignments of plants or plant products were examined fumigated or otherwise treated and necessary phytopathological certificates issued.

V. War Effort

1. *Ergot.* — Consequent on the success obtained last year in the production of ergot (at the Agricultural Research Station, Nanjanad) with a high alkaloid content, the Government was pleased to

sanction a special scheme for the production of ergot in South India, and for the investigation of optimum conditions for infection with a view to increased production.

Periodical sowings of rye.—In order to ascertain the best period for the cultivation of rye sowings were made in the first week of every month. In the months of April and May sowings were also made week by week. The crops sown in January and February were in head in April and June, respectively, and were sprayed with the fungus suspension at the flowering stage. The January-sown crop was sprayed in April, and on account of bright weather conditions prevailing at the time, infection was slow to take effect and spread was confined to a few earheads. The February-sown crop was sprayed in June and at the end of July infection was noticed in a few earheads only The April-sown crop was in earhead in July.

Bulk sowing of rye.—An area of 22·8 acres was sown with rye with a view to mass production of ergot.

Varietal trials.—Nine strains of rye from Simla obtained through the courtesy of the Imperial Economic Botanist and one from Australia have been sown in miniature plots to study their suitability for ergot production.

Other hosts of ergot.—In order to ascertain whether the rye strain of the fungus *Claviceps purpurea* is capable of infecting hosts other than rye in the Nilgiris a series of inoculation experiments were done under conditions favourable for infection. Oats, *Korali* (*Setraria glauca*), *Samai* (*Panicum miliare*) and thirteen other grasses were subjected to inoculation tests, but none of them took infection. A careful search in and about the farm among the various grasses growing, failed to reveal the presence of the fungus in any of them. This for the present rules out the possibility of the fungus spreading to other hosts and becoming a source of danger to cattle as was feared in some quarters when the work was first taken up.

Cultures of the fungus.—The fungus is successfully cultivated in sterilized rye, oat or barley grains. It grows best on rye, moderately well on oats, and sparsely on barley. The fungus grows well on sterilized rye earheads as well.

2. *Potatoes - Degeneration in storage* (*Black heart*).—Consequent on a report received from a firm engaged in processing potatoes for the fighting services, that potatoes obtained from the Nilgiris and dehydrated in their factory showed blackening of the finished product, investigation into the cause of the trouble was taken up. It was found that the discoloration was due to a physiological disorder known as ' black heart ' which develops in potatoes under conditions of inadequate aeration coupled with high temperature in storage and transit. Experiments carried out at Coimbatore showed that the symptoms of ' black heart ' did not develop if the

potatoes are kept stored in well-ventilated receptacles, but could be reproduced at will in ill-ventilated chambers kept at 34°C. Based on these experiments, suggestions were made for suitably altering the structure of potato storehouses in the hills and the plains, to provide for adequate aeration of the tubers while in storage. The requisite plans with details were also drawn up. The need for provision of ventilation facilities in the railway wagons was also pointed out, and steps have been since taken to have the improvements effected in some godowns both in the hills and the plains and to specially adapt existing railway vans for potato traffic.

3. *Production of food yeast.*—With a view to exploring the possibilities of manufacturing food yeast from cane molasses in South India, a small-scale laboratory plant was set up at Coimbatore and work was begun during the year with a culture of food yeast obtained from the Lister Institute in England by the Imperial Mycologist, New Delhi, and another from the Nutritional laboratories in Coonoor. Both the cultures represented a species of yeast, *Torulopsis utilis* which is valued highly for its vitamin contents. Under Coimbatore conditions both of them were found suitable for yeast production. A study is in progress for the determination of the conditions favouring optimum production. Samples of yeast prepared at Coimbatore were sent to the Nutritional laboratories at Coonoor for assay of vitamin contents, and the result of the analysis is given below :—

	Vitamin B µg/g	Nicotinic Acid µg/g
Sun-dried in solar drier	23·8	143·5
Oven dried at 45 to 55°C ..	24·4	148·5

The samples were considered as fairly good sources of the 'B' vitamins.

4. *Preparation of oxalic acid with the aid of the fungus—Sclerotium rolfsii.*—Waste products such as potato peel can be made use of for the production of oxalic acid. It has been found that certain fungi notably *Sclerotium rolfsii* are capable of effecting the conversion of carbohydrates in such material into oxalic acid. It was found that 1,500 mgm. of oxalic acid can be obtained from 100 grams of potato peel with the aid of a strain of *Sclerotium rolfsii* isolated in South India. The work is in progress, and the possibility of producing oxalic acid from other vegetable waste products is being explored.

VI. Propaganda.

Exhibitions.—Charts and posters were sent to exhibitions held during the year in different places.

Radio talk.—Three manuscripts were submitted by members and accepted for broadcasting. Sri C. R. Venkataraman and Sri K. Narayana Rao were recipients of the reward offered by the

Director of Agriculture for talks submitted by members of the department and accepted by the broadcasting authorities.

Leaflet.—A leaflet in English and Tamil explaining the provisions of Agricultural Pests and Diseases Act in respect of the control of wheat rust diseases was issued.

VII. Teaching.

Thirty-two lectures in mycology and plant pathology were delivered to the students of B. Sc. (Ag.) III and 35 practicals were conducted. Sixteen lectures and practical classes were held for the students of the short course in agriculture.

VIII. Advisory Work and Demonstrations in the districts

The Mycology and Entomology Demonstrators stationed in the districts attended to the various calls in connexion with outbreak of plant pests and diseases and demonstrated methods of control.

Eighty five specimens of diseased plants received for examination and technical advice were attended to during the year. Besides these 22 enquiries relating to a variety of plant pathological problems were also dealt with.

IX. Microtomy.

The microtome section continued to serve the needs of all the sections in the Institute as well as the officers to the districts. The following statement sums up the main work carried out in the section :—

Materials received	226
,, embedded	213
Number of blocks cut	182
,, of slides prepared	1,116
,, stained	1,035
,, mounted	1,077

X. Miscellaneous.

Publications.—The following papers were published :—(1) Experiments on Ergot production, by K. M. Thomas and T. S. Ramakrishnan.

(2) Mushroom cultivation, by K. M. Thomas, T. S. Ramakrishnan and I. L. Narasimhulu.

Coimbatore,
28*th August* 1943.

K. M. THOMAS,
Government Mycologist.